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Bulb studies: Part I. Comparative merits of some of the American and European grown bulbs : Part II. Growth studies of the gladiolus

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BULB STUDIES: PART I - COMPARATIVE MERITS OF SOME OF THE AMERICAN AND EUROPEAN GROWN BULBS.

PART II - GROWTH STUDIES OF THE GLADIOLUS.

By

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TABLE OF CONTENTS

Part I

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Part I

INTRODUCTION

The majority of bulbs which the florist is most interested in belong to the family Liliaceae and Amaryllidaceae. The United States has always imported these flowering bulbs from Europe without giving any great amount of consideration to the source of stock or the possibility of producing bulbs in this country. Such a condition was brought about because the American people could purchase these bulbs so cheaply and could always depend on receiving bulbs of good size and flowering qualities.

In the last six years there has been an exceedingly rapid increase in the number of bulbs that have been imported into the United States. During the year ending June, 1920, the United States had imported 152,516, 061 flowering bulbs. Five years later, or in 1926, the United States imported 276,022,753 bulbs, thus showing that there was a steady increase during these six years.

The main reasons for such an unusual increase is largely due to three factors: first, people in general are beginning to appreciate the great ease with which most of the bulbs of this flowering group can be grown, not only for one year, but that they readily adapt themselves to naturalization; second, florists have readily made use of these bulbs as a fore-

ing flower because through improved varieties they are very desirable for forcing; third, because of certain injurious insects and diseases which are likely to be, and which have been introduced into this country, the Federal Horticultural Board has passed a ruling which is now effective, that after January 1, 1926, the following bulbs can no longer be permitted to enter the United States except by permit for propagating purposes: narcissus, chionodoxa, eranthis, fritillaria, galanthus, ixia, muscari and scilla.

Unfortunately, the narcissus, which is by far the most important of our flowering bulbs, is included in this restricted list. Such a condition has caused much unrest among the merchants and various associations in behalf of the quarantine law, for it seems quite possible that such bulbs as tulips, hyacinths, crocus, lilies and lily of the valley will also carry many of the same diseases and insect pests as these bulbs which are now no longer available for commercial use. It goes without saying that the American people will not consider doing without these flowering bulbs which have for so many years been in such great favor. Thus, it has only been during the last few years that American growers have considered growing any of these said bulbs on a commercial scale, but as with other new undertakings, many American growers have been willing to tackle the proposition and are now growing bulbs quite successfully in many localities of the United States.

For the above reasons the writer wishes to present in Part I of this treatise a general survey of the American bulb industry and to determine through a thorough review of literature and experiments conducted how American grown bulbs will compare with European when grown under American conditions. Part II will be a discussion of growth studies of the gladiolus from literature and experimental work performed.

After a review was made of the available literature dealing with the bulb industry in America the writer was unable to arrive at definite conclusions. The results of various experiments were of very little value because no precise data had been recorded. It was decided therefore, that the experimental work should be conducted along the line of previous work carried on in the Department of Horticulture in the fall of 1924 and the spring of 1925 by Mr. Earle S. Carpenter (8).

LITERATURE REVIEW

The literature available on bulb culture is very limited, for very little scientific investigation has been conducted. Fortunately, the florists have, in the last few years, appreciated the growing demand of such flowering plants, consequently more literature is now available in trade papers as the Florists' Exchange, the Florists' Review and garden trade papers. The United States Department of Agriculture and State Agricultural Experiment Stations are also giving more attention to this valuable crop.

Consequently, the writer desires to present in a practical way through such a review of literature and experimental work conducted, the existing conditions of the American bulb industry and to present facts that have been determined under one year's observation and study.

Importance of Bulbs in the United States and the General Effect of the Plant Quarantine

We must first of all appreciate that the bulb industry as it exists in Europe today was not brought about in a short period of time, but that it has taken many generations for its development. Thus Kirby (19) states that, "narcissus, the ancient, small cupped and cluster-flowered sorts, were prized before history was recorded, is evidenced by wreaths of their

flowers being unearthed from tombs made hundreds of years before the Christian Era. That the popularity of narcissus increased with civilization is indicated by old Greek and Roman writings."

As related by Burbidge and Baker (7), Mr. Barr, an enthusiastic cultivator, who possessed a very complete collection of species and varieties in Europe, thus alludes to the early history of these beautiful flowers: "The narcissus is amongst the oldest and most beautiful of spring flowering bulbous plants. It has for centuries been one of the highly-prized garden favorites, and has commanded in an unusual degree the attention of the scientific botanist". Also Lobel, according to (7), makes mention of the culture of narcissus as far back as 1570; and later still, Gerard (1596) describes several kinds and varieties, that were very popular in the time of Elizabeth.

The tulip has also passed through a rapid change of development and is now considered one of the most desirable plants for forcing and naturalizing purposes. As stated by Keeler (18), "the origin of the cultivated tulip is lost in the mists of antiquity. The plant came into Europe by way of the Turk, the first seeds having been sent or brought to Vienna in 1554 by the Austrian Ambassador to the Sultan of Turkey. After the first introduction, the plants rapidly increased and were distributed very generally throughout Europe. A careful

description as well as several drawings of the plant were published by Konrad von Gesner, a Swiss botanist, who saw it growing at Augsburg in 1559. Holland was the producing center for the tulip as early as 1600, and the astonishing craze, known as "tulip mania" began in 1634 and lasted four years."

Although the United States has long imported bulbs from Europe, it has only been during the last few years that such an industry has attracted much consideration. As shown in Table 1, there has been a steady increase in the number of flowering bulbs imported during the last five years.

TABLE 1

Summary of Bulb Importations, 1920-21 to 1924-25

Bulbs	1920-21	1921-22	1922-23	1923-24	1924-25
Chionodoxa				339,766	465,422
Crocus	5,514,805	6,319,082	8,286,500	10,815,920	10,624,670
Eranthis				93,314	152,787
Fritillaria				92,951	104,483
Galanthus				797,381	895,003
Hyacinths	22,568,891	24,808,236	29,142,797	32,197,740	27,947,261
Ixia				335,158	371,985
Lily	22,490,533	8,219,460	9,145,630	9,690,486	11,207,559
Lily of the Valley	3,606,746	14,951,170	19,603,092	17,568,835	18,980,311
Muscari				612,329	904,259
Narcissus	77,956,195	77,270,548	77,193,281	92,659,666	106,314,049
Scilla				994,762	1,742,814
Tulips	55,075,348	64,846,940	76,719,116	92,539,157	96,290,452
Unclassified	4,756,369	70,780	183,900		
TOTAL	191,968,882	196,486,186	220,274,316	258,737,465	276,002,753

The main reason for such a rapid increase in the importation of bulbs into the United States is largely due to three reasons: first, such bulbs are being used more extensively for naturalization purposes; second, they are easily forced; and third, because of the application of new amendments to Quarantine No. 37.

Through the act of Congress, approved August 20, 1912, it was believed necessary that in order to prevent further introduction of injurious insect pests and fungous diseases into the United States, to forbid, except as provided by new rules and regulations, the importations into the United States of those plants, seeds and nursery stock which were included in Quarantine No. 37.

Until May 15, 1922, the following bulbs were included in this restricted list except by permit for propagation purposes: chionodoxa, galanthus, scilla, ixia, muscari, fritillaria and eranthis. Such a restriction on the above bulbs resulted in a very limited number for commercial use. May 15, 1922, it was deemed advisable that an amendment be made whereby such bulbs might enter under special permit for a term of three years, ending January 1, 1926, in order that the propagation supply could be replenished. The above amendment also provided that at the end of the three years, or January 1, 1926, that the narcissus should also be added to the restricted list.

As shown in Table 1, the narcissus is by far the most important of all the bulbs debarred. On account of this severe criticism arose among the commercial growers and organizations interested in Ornamental Horticulture. The outstanding criticisms are briefly listed as follows: (1) They believed that such protection should be accomplished with due and careful consideration of such an established industry and to its future developement. (2) There were many misinterpretations, iniquities and evidences of unfamiliarity with actual trading conditions. (3) It was believed that the exclusion of narcissus bulbs (except under special permit) was a typical example of a needless and unwarranted restrictive and a trade destroying method. (4) The growers could see no noticeable or reported no injurious results of insect pests and diseases during the three years when bulbs were permitted to enter.

Many clubs became active against the embargo and many resolutions of protest were made public and distributed among the growers and organizations. Letters were written to the Secretary of Agriculture in behalf of such restrictions. Conferences were called in order to afford opportunities for full reconsideration on the restriction of such an embargo. After all these considerations it was deemed best that the embargo should continue.

As with all new undertakings, the American people have entered into the bulb industry with great courage and de-

termination to produce bulbs of superior quality to those which have long been imported from Europe. Many of our greatest importers are now engaged in growing bulbs in America.

As stated by Miller (21), The American Bulb Company, which has been for many years the largest dealer and exclusive importer in foreign bulbs, protested at first against the embargo. The American Bulb Company was a great leader in organizing growers to combine in protest against such an embargo, but after receiving no encouragement that the embargo would be disregarded, The American Bulb Company became interested in organizing growers to carry on experimental work as to the possibility of growing bulbs in America. Mr. Miller (21) is a great believer that Americans will succeed with such an industry for he states, that before the embargo was passed on gladiolus, the Americans felt that it would be impossible to secure a sufficient quantity to take care of the demand if the embargo should go into effect. "In the seven years of the embargo, the American growers are producing more gladiolus bulbs than ever came from Europe, and these bulbs are now sold to the dealers and the American public at lower prices than previous to the embargo."

Americans have also made great strides in producing other bulbs that were formerly imported from Europe. Freesia bulbs are now being produced in California cheaper, better and in larger quantities than ever before.

Due to such an embargo the American government has

begun to realize more than ever the great importance of such an industry. According to Weigel (25), the Bureau of Entomology was requested by the Federal Horticultural Board to obtain reliable information and facts concerning the establishment and injuriousness in the United States of the insect pests that attack bulbs, especially the lesser bulb fly, and the larger narcissus or daffodil fly, as well as the bulb mite. In general, the conclusions indicate that except in a few instances, under certain conditions none of the pests appeared to be present and well established in sufficient abundance to constitute a really serious menace at the present time. Nevertheless, it is believed that the tremendous expansion which the bulb industry is now experiencing may tend to increase the risk of future injury from such insect pests.

Soil and Climatic Conditions of the Bulb Growing Districts of America as Compared With Those of Europe

The greatest question which is confronting the bulb growers of America is, will the cultivated varieties imported from Europe produce good flowers and good flowering bulbs in the United States as they have in various portions of Europe, or will it be necessary for the American growers to breed and select for new varieties?

Darwin (10) writes "there is hardly a climate or condition in the Old World which cannot be paralleled in the New,

at least as closely as the same species generally require." "No doubt" he states, "small areas can be pointed out in the Old World hotter than any in the New World; but these are not inhabited by a fauna different from that of the surrounding districts, for it is rare to find a group of organisms confined to a small area, of which the conditions are peculiar in only a slight degree."

Bailey (5) says in regard to American versus European flora that with the exception of some arctic and sub-arctic species, the plants of North America are singularly distinct from the European plants, although much like them. Although there are indications that there are some identical species, he (5) believes that the more closely they are studied the greater the differences of habit and distribution will appear to be. This dissimilarity has been brought about by the action of environment, especially climate. Bailey (5) believes that every plant is modified by the climate in which it is placed, and if any species are cultivated over a wide range of territory, we should expect to find it widely variable between the extremes of distribution. The same variety of apple, for instance, he states, may lose all its distinguishing qualities and characteristics if transferred to a climate far from its place of origin.

Thus, Bailey concludes, "American fruits constantly tend to diverge from the foreign types which were their parents, and they are, as a rule, better adapted to our environ-

ment than the foreign varieties. In less than a century, we have departed widely from the imported varieties which gave us a start. At the expiration of another century, we shall stand on a basis which is nearly, if not wholly, American."

If such conditions are true with fruits and other plants as are discussed above, it is probable to believe that flowering bulbs can be so improved through breeding and selections that they will be equal to or surpass those of European culture.

The usual method of propagating bulbs from a commercial standpoint is by the formation of bulbels, bulblets or corms, but nevertheless, many varieties will produce and mature seeds of good quality. Griffiths (13) states, "that at Bellingham, Washington, the following varieties of daffodils seed well: King Alfred, Van Waveren's Giant, Great Warley, Glory of Noordwijk, Weardale Perfection, Ard Righ, and Obvallaris. Princeps also seeds freely and comes mostly true from seed. Emperor, Golden Spur and Henry Irving seed rather sparingly. At Washington, D. C., King Alfred, Van Waveren's Giant, Hoboken, Herald, Vanilla, Herrick, Conqueror, Crispa, Harbinger, Commandant, Laura, Tresserve and Princeps seed quite freely. Emperor seeds sparingly."

It is believed that the United States displays nearly all the variations of climate and soil conditions known in the Temperate Zone. For this reason, many European growers and

people who are interested in bulb production in America are of the opinion that bulb production will prove successful in the United States. Thus Mr. Vos (24), who was a grower of bulbs in Holland for forty years and who is now growing bulbs at Grand Rapids, Michigan, is a great believer in that America can produce bulbs of good quality on a commercial scale. However, he warns against anyone attempting to grow narcissus bulbs without a thorough study of their requirements and the methods by which successful growers have succeeded. Attention to the many needs of each variety is absolutely necessary for success. Some varieties will produce rapidly with an increase of fertilizer and on the contrary, other varieties may become weakened and diseased by the application of too great an amount of fertilizer. Vos (24) also believes that with the fine sand in pliable soil which composes the greater portion of the soil of Michigan and the favorable climatic conditions of that state, that if "Dutch" bulbs can be grown successfully in America there is no place better adapted to their culture than the state of Michigan.

According to Gooch (12), the climate and soil conditions of Michigan are so much like that of England that the results in bulb growing and forcing cannot be expected to be much different in Michigan than in England. He also states that from his experience and reports which he has received from those who have forced Michigan grown bulbs, good results have

been obtained. "The bulbs are as large as Holland bulbs, throw as many blooms, and if handled earlier, will bloom earlier."

According to Griffiths (14), the commercial production of American grown bulbs has largely been confined to the Atlantic and Pacific coast, in the former, north of Norfolk, and along the Pacific coast, mainly north of San Francisco. The western bulb area is confined to more restricted limits, therefore it includes a territory which receives suitable rainfall and is sufficiently affected by sea coast conditions which prevents rapid transition from winter to summer. The heat and moisture conditions are not sharply defined in the eastern bulb area so that the bulb area is more indefinite as to width. Tulips and narcissus have been grown in the interior of the Ohio and Mississippi Valley for a period long enough and in sufficient quantities that without question there are many sections that show possibilities for successful bulb production of at least many varieties.

According to Scott (22), who has made a thorough study of the bulb growing industry in Holland and who is now growing bulbs on a commercial scale at Corfu, New York, "the theory of bulb growing may be the same the world over, but the practice of it will have to be governed by local conditions." He (22) is also of the opinion that there are sections of the United States which are very similar to climatic condi-

tions of Holland, but he is quite certain that there is no section in the United States which matches Holland in all conditions favorable to bulb growth and production. Although results at present are encouraging, several years of favorable results will be required before any definite conclusions can be made as to success of daffodil culture in western New York.

Griffiths (14) is of the opinion, based on experiments conducted at Bellingham, Washington, that at the present time, better tulips and narcissus bulbs have been produced on fine silty soil than upon a lighter sandy soil.

Griffiths (15) is also of the opinion in regard to the production of grape hyacinth that the Puget Sound region seems better adapted in many ways for the production of such a crop than does the Atlantic Coastal Plain. The main reason for such an argument is because he has noticed a great variation in the size of flowers produced. The flowers of the Pacific Northwest are slightly larger and the stems longer. He (15) states that many of the common varieties naturalize and continue to reproduce indefinitely in New York, Illinois, Mississippi, Alabama, Tennessee and many other states. It has also been noticed that in portions of Virginia and Michigan they are often considered as weeds. The soil requirements for such bulbs are not of great importance for they seem to thrive well on any well drained field soil of that region.

Griffiths (16) states, "that good tulips can be grown in America at a profit. They have already been produced in sufficient qualities for a period long enough to command respect."

"The tulips already produced experimentally are as good as the best. They bed, they force, they produce and they reproduce normally under American conditions. There is no limit to the quality of bulbs which it is possible to produce in the United States. We have climates that are unexcelled for the production of these stocks. We have regions with an abundant moisture supply from October to June, and we have dry summers. We have fertile sands, inexhaustible loams, and deep friable silts, upon all of which tulips can be grown."

According to the Florists' Review (1), practically all of the European growers are willing to give freely any information which will be of value to the American people, and the planting of much of our present acreage has been under the supervision and directions of European growers. For this reason there seems to be no sound basis for believing that there should be any acute shortage of bulbs in America after two or three seasons. The more important question is, will America be willing to continue her efforts which are necessary for such an industry that sufficient bulbs may be propagated to fulfill the demand.

The question of the forcing quality of the American grown bulbs is one of vital importance. Many growers have acknowledged that if the bulbs can be grown successfully in America, thus containing the flower in the embryonic stage, there is no question but what such bulbs will force earlier than European bulbs under similar forcing conditions.

The general belief is that most of our forcing failures with foreign bulbs can be directly traced to the damage sustained by the bulbs while being imported. For this reason it is believed that if the American growers will only give the bulbs due consideration and by not having to transport them for such long distances, the American bulbs will be more desirable for forcing.

Method of Bulb Production of Europe and America Compared

The long experience and practice of growing bulbs in Europe has led to great success in Ornamental Horticulture. There are, however, many disadvantages to such growing methods that are practiced in Europe, for under such conditions much hand labor is employed. The American growers are much interested in eliminating a great amount of this hand labor by adapting machinery which they believe will prove successful and at less cost. If hand labor is to be eliminated from such an industry, new methods must be brought into practice.

In Europe the bed method has always been the commer-

cial method and under such conditions the hand method, if cheap labor can be obtained, proves much more profitable than where machinery is used. As stated by Griffiths (16), "to determine whether there is a method superior to the bed system will require much experiment, and the question may not be settled for many years."

Tegelaar Brothers, Babylon, Long Island, according to (2) have come to the opinion after several years experimenting that they cannot afford to depart from the Dutch methods of bulb production. They are satisfied that the best lifting machine yet made is not the tool for bulb harvesting. "The quantity of bulblets left behind will out-balance the saving and make the keeping of true stock practically impossible. The Gladiolus growers can take a chance with bulblets, for most of those left in the ground, will freeze, but even they, when choice sorts are concerned, are hand lifted and hand sifted to insure all stock being saved."

In general there are many arguments in favor of both the American and European systems. The most outstanding in favor of the bed system are as follows: (1) A maximum quality of material can be grown in a given area. (2) The production of bulbs as practiced under this system is one of the most intensive of horticulture practices, and there is a decided advantage in thick and exhaustive cropping. (3) Bulbs may be placed in a more uniform depth.

The main arguments in favor of the American or row system are: (1) Implements may be used for preparing soil and cultivating. (2) Less hand weeding is necessary. (3) Less valuable land may be cultivated.

Frank Hubert (17), who established a narcissus nursery in the vicinity of Norfolk, Virginia, makes the following comments as to his opinion of the bulb growing possibilities in America as based on his experience about 25 years ago. "From experience in growing Narcissus in Virginia, we found that the strong growing varieties like Emperor, Empress and Princeps gave us good results and produced good forcing roots; but the Polyanthus varieties, like Soleil d'Or, Paperwhites, etc. also H. Irving and Golden Spur, did not produce satisfactory roots for forcing. They made their growth too early and the foliage would suffer from frost. There is no doubt that the climatic conditions in Guernsey are far more suitable for their growth and ripening. The heat waves during the spring in Virginia caused the bulb to ripen prematurely."

Barnhart (6), who is a large American grower, makes the following statement as to the American bulb growing industry: "I am fully persuaded that it is not a question of producing the bulbs in this country, and good ones, but rather one of cost, which planters, whether they be amateur or professional, are willing to pay. Freesias will never take the place of Narcissus."

Chervenka (9) is a believer that there are great possibilities along the Pacific coast for the bulb industry, and that the Quarantine No. 37 is a great stimulus to such an industry. He states that especially in the Puget Sound District, the climatic conditions are very favorable for the production of the highest type of forcing bulbs of narcissus, tulips and even hyacinths. Under such climatic conditions he believes that the American bulb industry should be developed in such a place.

The Federal Horticultural Board ruling on the interstate movement of narcissus bulbs Chervenka believes will be a stimulus that will aid toward establishing a successful industry; but its requirements must be carried out to insure success.

According to The Florists' Review (4), bulbs are being grown very successfully at Bellevue, Washington. The general method of growing bulbs by Mr. Reece at Bellevue has been by the common "Dutch" method, but during the last year he has radically departed from his former practices and is now using the American row plan, instead of planting in beds. The reason for adopting the American method is because less hand weeding is necessary.

Scott (22) who is familiar with bulb growing conditions at Corfu, New York, believes that although there are many disadvantages in growing bulbs in the western portion of

New York he also believes there are many advantages. Scott believes that the greatest disadvantage is probably their long severe winters, but such conditions are being overcome by heavy straw mulching. Although such a condition is a great disadvantage, such conditions as a cool fall which encourages early root development, and late cool spring rains are advantages which are greatly appreciated. Such conditions as exist in New York, Scott (22) believes make the bed system of planting more desirable than is the American row method.

Martin and Forbes (20) of Portland, Oregon, claim that narcissus and hyacinth bulbs when forced under the same conditions will bloom at least one month sooner than Holland stock of the same variety.

For the above reason Martin and Forbes believe that the American bulb industry will be a great success in the northwest.

In 1923 when the Department of Agriculture announced that Quarantine No. 37 was to be lifted against the narcissus until January 1, 1926, Stumpp and Walter Co. became interested in bulb production. At first they were much undecided where they should locate, but after considerable study Long Island was chosen.

According to Stumpp and Walter, the main reason why such a location was selected was because of suitable soil, transportation, and climatic conditions, including rainfall,

winter and summer temperatures, winds, and all factors that combine to influence the production of any plant. The company is doing all they can to meet the Department's requirements and from all evidence great success in bulb growing is being obtained.

MATERIAL AND METHODS

Material

The material used for comparative study consisted of twenty-four varieties of tulips and seven varieties of narcissus. Records were also recorded on eight varieties of tulips and four varieties of narcissus of which no comparison was made. Data for such varieties was recorded for general information and future study of varieties adapted for greenhouse forcing and naturalizing purposes.

The American Grown Bulbs were secured from the following companies:

Tulips

Seabrook Farm (Seab.) Bridgeton, N.J., 8 varieties.
Joe Smith (J. S.), Longbranch, Washington, 2 varieties.
Peter Vos (Vos), Grand Rapids, Michigan, 7 varieties.
Del-Bay Farm (Del.), Bridgeton, N.J., 19 varieties.

Narcissus

George Lawler (G. L.), Tacoma, Washington, 6 varieties.
Peter Vos (Vos), Grand Rapids, Michigan, 1 variety.
Del-Bay Farm (Del.), Bridgeton, N. J., 3 varieties.

The European Grown Bulbs were secured from the following companies:

Tulips

Vaughan's Seed Company (Vau.), Chicago, Illinois, 30 varieties.

Gray Floral Company (Gray), Albia, Iowa, 2 varieties.

Henry A. Dreer (Dreer), Philadelphia, Pa., 2 varieties.

Narcissus

Henry A. Dreer (Dreer), Philadelphia, Pa., 4 varieties.

Vaughan's Seed Company (Vau), Chicago, Illinois, 11 varieties.

Gray Floral Company (Gray), Albia, Iowa, 3 varieties.

TABLE 2

Record of Bulbs Secured. Date and Amount Planted in 1924 for Observation Made in 1926.

Variety		Bought of:	Total Bulbs:	Date Planted
TULIPS				
Prince of Austria	Am.	Seab.	6	Oct. 28, 1924
	Hu.	Gray	5	Oct. 28, 1924
Baron de la Tonnaye	Am.	Seab.	6	Oct. 28, 1924
		Vau.	6	Oct. 28, 1924
Turenne	Am.	Seab.	6	Oct. 28, 1924
	Hu.	Vau.	6	Oct. 28, 1924
Couronne d'or	Am.	Seab.	6	Oct. 28, 1924
	Hu.	Vau.	6	Oct. 28, 1924
Panorama	Am.	Seab.	6	Oct. 28, 1924
	Hu.	Vau.	6	Oct. 28, 1924
La Reine	Am.	J.S.	2	Oct. 28, 1924
	Hu.	Gray	6	Oct. 28, 1924
Artus	Am.	J.S.	3	Oct. 28, 1924
	Hu.	Vau.	6	Oct. 28, 1924
Keizerskroon	Am.	Seab.	9	Oct. 28, 1924
		Dreer	9	Oct. 28, 1924
Couleur Cardinal	Am.	Seab.	19	Oct. 28, 1924
	Hu.	Dreer	25	Oct. 28, 1924
Dream	Am.	Seab.	23	Oct. 29, 1924
	Hu.	Vau.	16	Oct. 29, 1924
NARCISSUS				
Emperor	Am.	G.L.	12	Oct. 31, 1924
	Hu.	Gray	13	Oct. 31, 1924
Sir Watkin	Am.	G.L.	13	Oct. 31, 1924
	Hu.	Gray	13	Oct. 31, 1924
Barri Conspicuus	Am.	G.L.	7	Oct. 31, 1924
	Hu.	Gray	7	Oct. 31, 1924
King Alfred	Am.	G.L.	5	Oct. 31, 1924
	Hu.	Dreer	6	Oct. 31, 1924
Empress	Am.	G.L.	12	Oct. 31, 1924
	Hu.	Dreer	12	Oct. 31, 1924
Princeps	Am.	Vau.	20	Oct. 31, 1924
	Hu.	Dreer	35	Oct. 31, 1924
Von Sion	Am.	G.L.	9	Nov. 20, 1924
	Hu.	Dreer	13	Nov. 20, 1924

TABLE 3

Record of Bulbs Secured, and Amount Planted (1925)

Variety		Bought of	Number Planted In Garden	Number Planted in Pots or Flats	Total Number of Bulbs
TULIPS					
Bacchus	Am.	Del.	0	25	25
	Bu.	Vau.	14	20	34
Fred Moore	Am.	Del.	22	77	99
	Bu.	Vau.	24	69	93
Inglescombe Pink	Am.	Del.	26	60	86
	Bu.	Vau.	15	60	75
Peach Blossom	Am.	Del.	25	60	85
	Bu.	Vau.	27	60	87
Couleur Cardinal	Am.	Del.	25	112	137
	Bu.	Vau.	24	121	145
Turenne	Am.	Del.	14	32	46
	Bu.	Vau.	15	40	55
Apricot	Am.	Del.	24	28	52
	Bu.	Vau.	17	32	49
Golden Bronze	Am.	Del.	27	33	60
	Bu.	Vau.	27	40	67
Picotee	Am.	Del.	27	20	47
	Bu.	Vau.	0	20	20
White Hawk	Am.	Del.	30	108	138
	Bu.	Vau.	27	108	135
Inglescombe Yellow	Am.	Del.	26	65	91
	Bu.	Vau.	23	65	88
Cardinal Manning	Am.	Del.	18	34	52
	Bu.	Vau.	0	35	35
Mr. Farncombe Sanders	Am.	Vos.	13	25	38
	Bu.	Vau.	36	68	104
Clara Butt	Am.	Vos.	13	30	46
	Bu.	Vau.	13	60	73
Baronne de la Tonnaye	Am.	Del.	16	25	41
	Am.	Vos.	15	24	39
	Bu.	Vau.	26	6	32
Gretchen	Am.	Del.	16	33	49
	Am.	Vos.	15	34	49
	Bu.	Vau.	29	35	64
Pride of Haarlem	Am.	Del.	31	40	71
	Am.	Vos.	0	25	25
	Bu.	Vau.	40	40	80
Mrs. Moto	Am.	Am.	81		
Wm. Copeland	Am.	Del.	25	30	55
	Am.	Vos.	15	35	50
	Bu.	Vau.	0	70	70

TABLE 3 (Cont'd)

Record of Bulbs Secured and Amount Planted (1925)

Variety		Bought of	Number Planted in Garden	Number Planted in Pots or Flats	Total Number of Bulbs
TULIPS					
La Tulip Noire	Am.	Del.	0	70	70
	Am.	Vos.	0	5	5
	Bu.	Vau.	32	25	57
Reverend Ewbank	Am.	Del.	11	0	11
	Bu.	Vau.	15	40	55
Murillo	Bu.	Vau.	41	134	175
Flamingo	Bu.	Vau.	36	227	263
Parrot Mixed	Bu.	Vau.		25	25
Bizarres	Bu.	Vau.		22	22
Bybloemen	Bu.	Vau.		10	10
Couronne d'or	Bu.	Vau.	41	70	111
Mon Tresor	Am.	Del.	13	108	121
	Bu.	Vau.	26	108	134
NARCISSUS					
Von Sion	Bu.	Vau.		248	248
Empress	Am.	Del.		125	125
	Bu.	Vau.		126	126
Sir Watkin	Am.	Vos.		159	159
	Bu.	Vau.		204	204
Grange Phoenix	Bu.	Vau.		24	24
Princeps	Bu.	Vau.		251	251
Poeticus	Bu.	Vau.		17	17
Emperor	Am.	Del.		224	224
	Bu.	Vau.		54	54
Golden Spur	Bu.	Vau.		716	716
King Alfred	Am.	Del.		77	77
	Bu.	Vau.		270	270
Barrii Conspicuus	Bu.	Vau.		50	50
Spring Glory	Bu.	Vau.		162	162

Methods

The methods used in growing the bulbs for a comparative study (1925-26) was conducted as near as possible on a commercial basis. The bulbs which were obtained from Mr. Vos of Grand Rapids, Michigan, and those from the Del-Bay Farm, Bridgeton, New Jersey, were used to represent American grown stock. The bulbs used to represent European grown stock were obtained from Vaughan's Seed Company, Chicago, Illinois.

The bulbs were so ordered that they were to be delivered as near as possible at the same date in order that they could be handled and stored under the same conditions. The date on which the bulbs arrived varied about ten days. However, the greater portion was received about October 1st.

Upon arrival, the bulbs were unpacked, bags opened and bulbs examined. They were then stored in the potting room in the Plant Laboratory building until time of potting.

The ninth of October the bulbs were potted in various size pots and flats, care being used that bulbs of corresponding varieties of American and European grown were planted in pots or flats of the same size under similar conditions.

The potting soil which was used consisted of general greenhouse compost soil which had been well mixed and screened.

The same day which the bulbs were planted they were placed in cold frames. They were then watered and covered over with sand and soil.

The reason for placing the bulbs under such conditions was because such a place was the best available at that time, for the storage cave which was under construction was not completed until December. December 10th the bulbs were moved from the cold frame to the storage cave where more desirable storing conditions were available.

The temperature of the cave was held very constant, the average temperature ranging from 35 degrees to 40 degrees F.

Beginning February 10th, and at intervals of one week to ten days, a portion of the bulbs of many varieties of American and European grown were brought in from storage. The bulbs were first placed in a cool greenhouse where the temperature ranged from 45 degrees to 55 degrees F. The bulbs were not exposed to direct sunlight but were kept covered with newspapers until the foliage had taken on a green color. The bulbs remained in the cool house until they had made proper growth which warranted more heat and sunlight. The number of days necessary for such development depended on the amount of sunlight and the variety being forced. In each case, however, the American and European bulbs for the same variety were treated under like conditions.

There was not in all cases a comparison made between bulbs of each variety for each of the three companies.

The method of taking data on the bulbs was conducted

as near as possible for all corresponding varieties of American and European grown. As soon as the bulbs were brought in from storage the pots or flats were so arranged that corresponding bulbs of the same variety were grouped together. By so arranging the bulbs, data could be more readily recorded with more accurate results.

The measurements which were taken were made as accurately as possible, for often times it was only through such measurement that any pronounced differences could be determined. In all cases the measurements were made in centimeters. Each individual plant was measured and the average for all plants in pot or flat recorded. The measurements for height and length of stems were not recorded in tenth of centimeters but to the closest whole number.

In general, the length of flowering stems for most varieties seems unreasonably short. Such a condition was greatly due to the time in which the final measurements were made. From observation it was noted that there was a rapid elongation in the flowering stem after the flower had opened. When such a condition was considered it was thought best that measurements should be made at some (definite)? different time during the blooming period.

Growers who force bulbs for commercial use are much concerned that the stems for such bulbs should be long when the flowers first open, for this is the stage of the plants

development when they are most desirable for sale. For this reason the length of stems were recorded when the plant was in full bloom or during the early stage of blooming.

TABLE 4

A Comparative Test of American and European Grown Narcissus of the Same Variety Forced Under Greenhouse Conditions

Variety Sir Watkin

	Date Brot. in From Storage	Weekly Growth: When Brot. in	1st. Week	2nd. Week	No. of Days in Cool Room	No. of Bulbs	Date of First Bloom	Date of Last Bloom	Quality of Blooms: Size, etc.	Quality of Foliage	Average Length of Flower Stem	Total No. of Flowers	Diameter of the Flower	Length of Trumpet (cm.)	Av. No. of Flowers per Bulb
Vos.	2/10	3	7	28	7	44	2/23	3/11	G	G	33	51	7.8	2.5	
Vau.		2	4	18	7	50	2/25	2/29	G	G	32	60	7.6	2.4	
Vos.	2/17	5	11	29	14	15	3/5	3/9	G-	G-	36	17	8.1	2.5	
Vau.		3	7	28	14	10	3/6	3/9	M	M	36	11	8.1	2.5	
Vos.	3/3	4.5	14	30	7	60	3/15	3/18	G	G	34	72	8.2	2.5	
Vau.		3	13	30	7	60	3/16	3/19	G	G-	35	71	8.2	2.5	
Vos.	3/10	4.5	14	25	7	20	3/21	3/26	G	G	33	25	8.3	2.6	
Vau.		2.5	10	25	7	30	3/24	3/29	G	G	33	29	8.3	2.5	
Vos.	3/17	4	13	27	7	10	3/30	4/1	G	G	31	12	8.4	2.6	
Vau.		3	13	27	7	5	3/30	3/31	M	G	28	4	8.2	2.3	
		App. Average				Total			App. Average			Total	Average		
Vos.		4	12	27		159			G	G	33	177	8.1	2.5	1.11
Vau.		3	9	25		155			G-	G-	32	195	8.1	2.4	1.25

TABLE 5

A Comparative Test of American and European Grown Narcissus of the Same Variety Forced Under Greenhouse Conditions

Variety King Alfred

	Date Brot. in From Stor-age	Weekly Growth When Brot. in	1st. Week	2nd. Week	No. of Days in Cool Room	No. of Bulbs	Date of First Bloom	Date of Last Bloom	Quality of Blooms Size, etc.	Qual-ity of Fol-iage	Aver-age Length of Flower Stem	Total No. of Flow-ers	Diam-eter of the Flow-er	Length of Trump-et (cm.)	Av. No. of Flow-ers per Bulb
Del.	2/17	9	24	32	14	23	3/1	3/5	G +	G	40	51	9	4.5	
Vau.		4	12	27	14	54	3/3	3/6	G	G	39	37	7.8	4.2	
Del.	3/10	7	23	30	7	54	3/19	3/24	E	E	38	79	8.9	4.2	
Vau.		4	20	27	7	54	3/20	3/26	E	E	37	49	8.8	4.3	
		App. Average				Total			App. Average			Total	Average		
Del.		8	23	31		77			E -	G+	39	110	9-	4.4	1.42
Vau.		4	16	27		108			G +	G+	38	86	8.3	4.2	.79

TABLE 6

A Comparative Test of American and European Grown Narcissus of the Same Variety Forced Under Greenhouse Conditions

Variety Empress

	Date Brot. in From Storage	Weekly Growth: When Brot in	1st. Week	2nd. Week	No. of Days in Cool Room	No. of Bulbs	Date of First Bloom	Date of Last Bloom	Quality of Blooms: Size, etc.	Quality of Foliage	Average Length of Flower Stem	Total No. of Flowers	Diameter of the Flower	Length of Trumpet (cm.)	Av. No. of Flowers per Bulb
Del.	2/10	2	4	10	7	48	3/15	3/18	G	G	40	12	8.8	3.25	
Vau.		3	5	19	7	48	3/2	3/14	G	G	33	7	8.8	3.25	
Del.	2/17	5	11	29	14	62	3/5	3/13	G	G	32	50	8.2	3.8	
Vau.		3	8	29-	14	62	3/7	3/17	G-	G-	31	63	8.2	3.7	
Del.	3/3	4	14	35	7	15	3/18	3/21	E	G	30	18	8.2	4+	
Vau.		3	10	21	7	15	3/19	3/23	G+	G	26	11	8.2	4+	
		App. Average				Total			App. Average			Total	Average		
Del.		3	10	21		125			G+	G	34	80	8.4	3.6	.64
Vau.		3	8	23		125			G	G-	30	81	8.4	3.6	.64+

TABLE 7

A Comparative Test of American and European Grown Narcissus of the Same Variety Forced Under Greenhouse Conditions

Variety Emperor

	Date Brot. in From Stor-age	Weekly Growth: When Brot. in Room	1st. Week	2nd. Week	No. of Days in Cool Room	No. of Bulbs	Date of First Bloom	Date of Last Bloom	Quality of Bloome Size, etc.	Quality of Fol-iage	Average Length of Flower Stem	Total No. of Flow-ers	Diameter of the Flow-er	Length of Trump-et (cm.)	Av. No. of Flow-ers per Bulb
Del.	3/10	1	6	22	7	54	3/29	4/4	G	G	28	42	8.7	3.8	.77
Van.		1	6	23	7	62	3/29	4/4	G	G	30	56	7.6	3.7	.90

A Comparative Test of American and European Grown Narcissus of the Same Variety Forced Under Greenhouse Conditions. Tables 4 to 7 inclusive.

Variety Sir Watkin

The comparison of this variety was that of Vos (America) and Vau (European). As indicated by Table 4, the time of blooming was somewhat earlier for the American grown. Also the quality of bloom, quality of foliage, length of stems were slightly superior to the European grown. The percent of flowers which bloomed was 14 percent greater in favor of European bulbs.

Variety King Alfred

According to Table 5, the American grown bulbs of this variety were more desirable for forcing. The time of blooming for the American and European bulbs was about the same, slightly in favor of the American grown. The quality of blooms and foliage is approximately the same but the size of flowers and percent of blooming is much greater for the American grown.

Variety Emperor

Practically no difference could be detected in American and European grown bulbs of this variety according to Table 6. There was only a slight difference in quality of bloom, quality of foliage and length of stem in favor of the American grown. Bulbs of both the American and European

grown did not bloom as freely as they have previous years. The percent of blooming was approximately sixty-four percent in both cases.

Variety Emperor

Only one planting was made of this variety. As indicated by Table 7, there was but very little in favor of either the American or European grown over the other. The size of flowers was larger than the European grown but the percent of blooming is thirteen percent greater for the European.

TABLE 8

Best Date for Forcing Narcissus

Name of Variety	Amer. or Eur.	Date Forced	Date of First Bloom	Quality of Bloom	Quality of Foliage	Number of Bulbs	Number of Blooms
Von Sion	Eu.	2/10	2/23	G	G	54	105
	Am.	3/3	3/18	E	G	15	18
Empress	Eu.	3/3	3/19	G+	G	15	11
	Am.	3/3	3/15	G	G	60	72
Sir Watkin	Eu.	3/3	3/16	G	G-	60	71
Orange Phoenix	Eu.	3/3	4/2	G	G	12	14
Princeps	Eu.	3/3	3/18	G	M	54	70
Poeticus	Eu.	3/3	3/20	G-	G	11	11
	Am.	3/10	3/29	G	G	54	42
Emperor	Eu.	3/3	3/28	G	M	108	116
Golden Spur	Eu.	3/3	3/13	G	G-	177	197
	Am.	3/10	3/19	M	E	54	79
King Alfred	Eu.	3/10	3/20	E	E	54	49
Barrii Conspicuus	Eu.	3/10	3/26	E	G	50	83
Spring Glory	Eu.	3/10	3/19	E	E	108	135

Best Date for Forcing Narcissus

The best date for forcing narcissus did not vary as much as did the time for forcing tulips. As shown in Table 8, bulbs which were brought in from storage March 3rd and March 10th responded best for forcing. There is but little difference in time of forcing for American and European grown narcissus bulbs (1926).

Results of the Second Year's Growth of American and European Grown Narcissus Under Garden Conditions

Narcissus bulbs of many varieties were planted in the formal garden for a comparative study of American and European grown in the fall of 1924. In the spring of 1925, records were taken and recorded. The bulbs were not dug but were permitted to flower in 1926.

In the spring of 1926, data was again taken and recorded as shown in Table 9. The bulbs were then permitted to grow and ripen. July 24th the bulbs were dug and stored until August 17th, when all the bulbs were cleaned. At the time of cleaning all bulbs were graded according to size and quality.

Results from Table 9 indicate that American grown narcissus will grow, bloom and reproduce equally well as the European grown. The time of blooming is practically the same.

TABLE 9

Results of the Second Year's Growth of American and European Grown Narcissus Under Garden Conditions

Name of Variety		No. of Bulbs	No. Dead Bulbs	Date of First Bloom	Date of Last Bloom	Quality of Bloom	Quality of Foliage	Av. Length of Stem	No. of Blind Bulbs	Total No. of Flowers	Percent of Bloom Per Bulb	No. and Quality of Bulbs
Emperor	Am.	12	0	4/21	4/24	G	G	18	0	20	15G 12M 7P	166.8
	Eu.	13	1	4/21	4/23	G	G	29	0	6	13G 11M 12P	46.1
Sir Watkin	Am.	13	1	4/17	4/22	M	G	25	0	42	12G 22M 23P	323.1
	Eu.	13	1	4/16	4/20	M	G	25	0	29	17G 16M 22P	223.1
Barri Conspicuus	Am.	7	0				M	22	0	0	2G 15M 2P	00
	Eu.	7	1				M	27	6	0	6G 11P	00
King Alfred	Am.	5	0	4/16	4/23	M+	M	27	0	6	11M	120
	Eu.	5	0	4/16	4/20	M	G	26	0	5	7G 4M 9P	100
Empress	Am.	12	0	4/19	4/23	M	G	31	0	26	15G 8M 15P	217.7
	Eu.	12	0	4/19	4/22	M	G	30	0	29	16G 19M 11P	241.7
Princeps	Am.	20	0	4/14	4/20	M	M	29	9	11	10G 20M 7P	55
	Eu.	35	0	4/16	4/23	M	M	29	19	18	13G 15M 30P	51.4
Von Sion	Am.	9	0	4/24	4/24	M	M+	32	6	2	12G 7M 25P	22
	Eu.	13	0	4/20	4/23	M	M	30	1	8	17G 7M 3P	61.5

TABLE 10

A Comparative Test of American and European Grown Tulips of the Same Variety Forced Under Greenhouse Conditions

Variety Bacchus

	Date Brot. in From Storage	Weekly Growth When Brot. in	Weekly Growth 1st. Week	Weekly Growth 2nd. Week	Days in Cool Room	Number of Bulbs	Date of First Bloom	Date of Last Bloom	Quality of Blooms	Quality of Foliage	Average Length of Stems	Number of Blind Bulbs	Total Number of Flowers	Percent of Bulbs Which Bloomed
Del.	2/10	7	12	21	7	9	3/9	3/12	8G	G	33	1	8	
Vau.		4	13	21	7	4	3/9	3/10	4G	G	28	0	4	
Del.	2/17	9	14	25	14	8	3/15	3/21	4G+4M+	G	36	0	8	
Vau.		7	10	25	14	8	3/17	3/20	8G+	G+	37	0	8	
Del.	3/3	10	16	22	7	4	3/29	3/29	4G	G	35	0	4	
Vau.		8	15	26	7	4	3/28	3/29	4G	G	36	0	4	
Del.	3/10	8	15	30	7	4	4/1	4/4	3G 1M	M	37	0	4	
Vau.		7	16	27	7	4	4/3	4/5	8G	G	39	0	4	
		App. Average				Total			App. Average			Total		
Del.		9	14	25		25			G-	G-	35	1	24	96
Vau.		7	14	25		20			G	G	35	0	20	100

A Comparative Test of American and European Grown Tulips of the Same Variety Forced Under Greenhouse Conditions

Variety Bacchus (Table 10)

The Bacchus variety of both American and European grown proved to be one of the very best for inside forcing. As shown in Table 10, from a total of 45 bulbs only one failed to bloom. The foliage and flowers from the European grown bulbs were somewhat superior in quality and substance because the foliage of the American grown bulbs showed considerable tip-burning, thus resulting in blooms and foliage of inferior quality and substance when compared with the European grown. The time of blooming was slightly in favor of the American grown.

Variety Fred Moore (Table 11)

With the exception of slight tip burning of the American bulbs of this variety, there was but little in favor of the European grown. In each case the American grown bulbs bloomed one day earlier, but the foliage and percent of blooming was slightly in favor of the European.

TABLE 11

A Comparative Test of American and European Grown Tulips of the Same Variety Forced Under Greenhouse Conditions

Variety Fred Moore

	Date Brot. in From Stor-age	Weekly Growth When Brot. in	1st. Week	2nd. Week	Days in Cool Room	Number of Bulbs	Date of First Bloom	Date of Last Bloom	Quality of Blooms	Quality of Foli-age	Average Length of Stems	Number of Blind Bulbs	Total Number of Flow-ers	Percent of Bulbs Which Bloomed
Del.	2/10	4	10	15	7	58	2/27	3/6	3G 2G	M	16	0	58	
Van.		3	7	13	7	64	2/28	3/6	5G 5G	M+	16	1	63	
Del.	2/17	3.5	5	9	14	19	3/10	3/12	2G 1G	M+	23	2	17	
Van.		3	5	22	14	5	3/11	3/12	5G-	G	25	0	5	
		App. Average				Total			App. Average			Total		
Del.		4	8	12		77			M+	M+	20	2	75	97.4
Van.		3	6	18		69			M+	G-	21	1	68	98.5

TABLE 12

A Comparative Test of American and European Grown Tulips of the Same Variety Forced Under Greenhouse Conditions

Variety Inglescombe Pink

	Date Brot. in From Storage	Weekly Growth When Brot. in	Weekly Growth 1st. Week	Weekly Growth 2nd. Week	Days in Cool Room	Number of Bulbs	Date of First Bloom	Date of Last Bloom	Quality of Blooms	Quality of Foliage	Average Length of Stems	Number of Blind Bulbs	Total Number of Flowers	Percent of Bulbs Which Bloomed
Del.	2/10	4	10	22	7	5	3/14	3/16	4G	M	35	1	4	
Vau.	2/10	2.5	6	19	7	10 (1 dead)	3/14	3/21	1G 2M	M	36	6	3	
Del.	2/17	7	14	25	14	10	3/20	3/22	3G	P.	37	0	10	
Vau.		5	10	21	14	10	3/22	3/25	5G 1M	M	34	4	6	
Del.	3/3	7	14	22	7	30	4/1	4/8	1G 3M 2P	M	34	7	23	
Vau.	3/3	5.5	13	25	7	25 (4 dead)	3/29	4/7	1G 2M	M	42	7	14	
Del.	3/10	6	17	24	7	15	4/2	4/9	5G 7M 1P	M	34	2	13	
Vau.	3/10	3	13	22	7	15	4/6	4/9	8G 2M 1P	M	34	4	11	
	App. Average	6	14	23		Total 60			App. Average G-	M	35	Total 10	50	83.3
Vau.		4	11	22		60			G-	M	37	21	34	56.6

Variety Ingleseombe Pink (Table 12)

The period of blooming for this variety was approximately the same for the American and European grown bulbs, varying somewhat at different intervals or dates at which the bulbs were forced. The quality of blooms and foliage of the American grown were equal to the European and the percentage of blooming was 26.7 percent greater.

Variety Peach Blossom (Table 13)

In all factors studied with the exception of tip-burning, the American grown bulbs of this variety were equal to or superior to the European. The percent of blooming is ten percent greater for the American bulbs. For some unaccountable reason the flowers of the European bulbs which were forced March 3rd, and the American bulbs which were forced March 10th, were green in color at the time of blooming but later changed to normal color.

TABLE 13

A Comparative Test of American and European Grown Tulips of the Same Variety Forced Under Greenhouse Conditions

Variety Peach Blossom

	Date Brot. in From Stor-age	Weekly Growth When Brot. in	1st. Week	2nd. Week	Days in Cool Room	Number of Bulbs	Date of First Bloom	Date of Last Bloom	Quality of Blooms	Quality of Foli-age	Average Length of Stems	Number of Blind Bulbs	Total Number of Flow-ers	Percent of Bulbs Which Bloomed
Del.	2/10	4	6	13	7	15	3/2	3/5	15M	M	16	0	15	
Vau.		3	6	13	7	15 (1 dead)	2/28	3/4	12M	M	16	1	13	
Del.	2/17	6	6	20	14	20	3/10	3/12	12G 7M	G-	21	1	19	
Vau.		4	6	16	14	20	3/10	3/13	3G 11M 2P	G-	17	3	17	
Del.	3/3	5	8	13	7	15	3/20	3/21	3M	G	24	0	15	
Vau.		5	8	12	7	15	3/20	3/22	12G 2P	G	24	1	14	
Del.	3/10	4	10	21	7	10	3/27	3/30	3G 7M	G	25	0	10	
Vau.		4	10	22	7	10 (1 dead)	3/26	3/29	9M	G-	26	0	9	
	App. Average				Total				App. Average			Total		
Del.	5	8	17		60				G-	G-	22	1	59	98.3
Vau.	4	8	16		60				M+	G-	21	5	53	88.3

TABLE 14

A Comparative Test of American and European Grown Tulips of the Same Variety Forced Under Greenhouse Conditions

Variety Couleur Cardinal

	Date Brot. in From Storage	Weekly Growth When Brot. in	1st. Week	2nd. Week	Days in Cool Room	Number of Bulbs	Date of First Bloom	Date of Last Bloom	Quality of Blooms	Quality of Foliage	Average Length of Stems	Number of Blind Bulbs	Total Number of Flowers	Percent of Bulbs Which Bloomed
Del.	3/3	1	8	14	7	54	4/2	4/6	20G 22M6P	M	17	4	50	
Vau.		1	3	15	7	54	4/1	4/4	46G 8M	G	22	0	54	
Del.	3/10	3	11	20	7	54	3/29	4/3	6G 48M	G	21	0	54	
Vau.		1	6	10	7	54	4/5	4/12	20G 15M10P	M	15	9	45	
Del.	4/12	12	18		0	4				P	25	4	0	
Vau.		11	16			13	4/26	4/29	9G 3M	G	19	1	12	
		App. Average				Total			App. Average			Total		
Del.		5	12	17		112			M+	M	21	8	104	92.8
Vau.		4	8	13		121			G-	G-	19	10	111	91.6

Variety Couleur Cardinal (Table 14)

As indicated by Table 14, both the American and European grown bulbs forced satisfactorily. The quality of blooms and foliage of the European bulbs was somewhat superior to the American, but the length of stems and percentage of blooms was less than those of American origin. No reason can be stated for the failure of bloom for the American grown bulbs which were forced April 12th.

Variety Tureene (Table 15)

The American bulbs of this variety came into flowering somewhat earlier than did the European. The substance and quality of the blooms were approximately the same but the quality of foliage and percent of bloom was greater for the European. There was also a trace of tip-burning among the American bulbs. Bulbs of both the American and European grown were not as good as was expected.

TABLE 15

A Comparative Test of American and European Grown Tulips of the Same Variety Forced Under Greenhouse Conditions

Variety Turenne

	Date Brot. in From Storage	Weekly Growth When Brot. in	Weekly Growth 1st. Week	Weekly Growth 2nd. Week	Days in Cool Room	Number of Bulbs	Date of First Bloom	Date of Last Bloom	Quality of Blooms	Quality of Foliage	Average Length of Stems	Number of Blind Bulbs	Total Number of Flowers	Percent of Bulbs Which Bloomed
Del.	3/10	5	12	24	7	15	3/10	3/13	6G	P	37	10	6	
Vau.		3	8	20	7	15	3/10	3/17	3M	M	30	12	3	
Del.	3/3	10	18	24	7	12	3/29	4/3	2G 1M	P	29	9	3	
Vau.		5	10	21	7	20	4/2	4/4	15G	M	35	5	15	
Del.	3/10	7	25	35	7	8	4/6	4/7	2G	M	45	3	2	
Vau.		4	11	27	7	5	4/8	4/9	4G	M	36	1	4	
		App. Average				Total			App. Average			Total		
Del.		7	18	27		32			G-	F+	37	22	10	31.2
Vau.		4	9	23		40			G-	M	34	18	22	55

TABLE 16

A Comparative Test of American and European Grown Tulips of the Same Variety Forced Under Greenhouse Conditions

Variety Clara Butt

	Date Brot. in From Storage	Weekly Growth When in	Weekly Growth 1st. Week	Weekly Growth 2nd. Week	Days in Cool Room	Number of Bulbs	Date of First Bloom	Date of Last Bloom	Quality of Blooms	Quality of Foliage	Average Length of Stems	Number of Blind Bulbs	Total Number of Flowers	Percent of Bulbs Which Bloomed
Vos.	2/10	3	8	13	7	5	3/15	3/17	3S	G	30	2	3	
Vau.	2/10	2	7	16	7	20	3/14	3/18	17S 2P	G	33	1	19	
Vos.	2/17	4	8	18	14	15	3/22	3/26	9S 6M	M-	33	1	14	
Vau	2/17	4	8	19	14	15	3/22	3/26	8S 4M 3P	M-	34	0	15	
Vos.	3/3	5	9	13	7	5				P	15	5	0	
Vau.	3/3	5	10	25	7	20	4/1	4/6	7S 10M	M+	41	3	17	
Vox.	3/10	5	13	21	7	5	4/6	4/8	3P	M	31	2	5	
Vau.	3/10	5	12	28	7	5	4/7	4/10	4M 1P	M	40	0	5	
	App. Average				Total				App. Average			Total		
Vos.	4	10	16		30				M+	M	26	10	20	66.6
Vau.	4	9	17		60				M+	M+	37	4	56	93.3

Variety Clara Butt (Table 16)

The time of blooming as indicated by Table 16 was approximately the same for American and European forced bulbs. The quality of bloom of the American bulbs is equal to the European grown but the quality of foliage, length of flowering stems and the percent of blooming is inferior to the European grown.

Variety Pride of Haarlem (Table 17)

The American bulbs of this variety bloomed somewhat earlier than the European grown. Also the blooms and foliage were of more desirable quality and the percent of flowering was much greater for the American bulbs. No explanation can be given for the failure to bloom of the American (Vos) and European bulbs at various dates as shown in Table 17.

TABLE 17

A Comparative Test of American and European Grown Tulips of the Same Variety Forced Under Greenhouse Conditions

Variety Pride of Haarlem

	Date Brot. in From Stor-age	Weekly Growth When Brot. in	Weekly Growth 1st. week	Weekly Growth 2nd. Week	Days in Cool Room	Number of Bulbs	Date of First Bloom	Date of Last Bloom	Quality of Blooms	Quality of Foliage	Average Length of Stems	Number of Blind Bulbs	Total Number of Flowers	Percent of Bulbs Which Bloomed
Del.	2/17	6	11	22	14	10	3/28	3/23	4E	G-	32	6	4	
Vos.		5	10	21	14	15				F	26	15	0	
Vau.		5	10	25	14	15				F	27	15	0	
Del.	3/3	4	12	18	7	5	3/30	4/1	2G	M	26	3	2	
Vos.		5	12	24	7	5	3/31	4/5	4M	M	28	1	4	
Vau.		4	11	20	7	5				F	25	5	0	
Del.	3/10	6	15	28	7	15 (2 dead)	4/2	4/6	8G	G-	34	5	8	
Vau.		6	17	24	7	15 (1 dead)	4/4	4/8	10G 2M 1P	G	40	1	13	
Del.	3/17	5	12	23	7	10	4/7	4/10	6G 2M	M	28	2	8	
Vos.		3	9	22	7	5	4/9	4/12	4G 1P	M+	36	0	5	
Vau.		1	7	17	7	5				P+	25	5	0	
		App. Average				Total				App. Average		Total		
Del.		5	13	23		40				G	M+	32	16	22	55.
Vos.		4	10	22		25				M	M	33	16	9	36.
Vau.		4	11	21		40				M-	M-	29	26	13	32.5

TABLE 18

A Comparative Test of American and European Grown Tulips of the Same Variety Forced Under Greenhouse Conditions

Variety Picotee

	Date Brot. in From Storage	Weekly Growth When Brot. in	Weekly Growth 1st. Week	Weekly Growth 2nd. Week	Days in Cool Room	Number of Bulbs	Date of First Bloom	Date of Last Bloom	Quality of Blooms	Quality of Foliage	Average Length of Stems	Number of Blind Bulbs	Total Number of Flowers	Percent of Bulbs Which Bloomed
Del.	2/17	7	12	27	14	10	3/18	3/20	8G	M-	33	2	8	
Vau.		6	9	26	14	10	3/19	3/23	9G 1M	M-	37	0	10	
Del.	3/3	4	13	25	7	10	3/28	4/3	8M	M	38	2	8	
Vau.		5	11	22	7	10	3/31	4/3	10M+	M	35	0	10	
		App. Average				Total			App. Average			Total		
Del.		6	13	26		20			M+	M	36	4	16	80
Vau.		6	10	24		20			M+	M-	36	0	20	100

Variety Picotee (Maiden Blush) (Table 18)

The greatest objection to the Picotee variety of both the American and European grown bulbs was, the stems were exceedingly weak. Such a condition was much more noticeable in those bulbs which were forced early, as later in the season the stems obtained more strength and quality. The percent of blooming is 20 percent greater for the European grown.

Variety White Hawk (Table 19)

The quality of bloom, foliage, length of stems and percent of bulbs bloomed is superior in the European grown bulbs. In general, however, the American bulbs bloomed a few days earlier but such early blooming seemed to be detrimental for the flowers opened before the stems had fully developed.

TABLE 19

A Comparative Test of American and European Grown Tulips of the Same Variety Forced Under Greenhouse Conditions

Variety White Hawk

	Date Brot. in From Stor. age	Weekly Growth When Brot. in	Weekly Growth 1st. Week	Weekly Growth 2nd. Week	Days in Cool Room	Number of Bulbs	Date of First Bloom	Date of Last Bloom	Quality of Blooms	Quality of Foliage	Average Length of Stems	Number of Blind Bulbs	Total Number of Flowers	Percent of Bulbs Which Bloomed
Del.	2/10	3.5	5	11	7	54	2/22	3/5	48M	P	16	6	48	
Vau.		3	5	7	7	54	2/25	3/7	50P*	P	12	4	50	
Del.	3/10	2	9	11	7	54	3/26	3/31	32M	P*	20	22	32	
Vau.		1	6	10	7	54	3/30	4/3	200 12M	M	21	19	35	
		App. Average				Total			App. Average			Total		
Del.		3	7	11		108			M	P*	18	28	80	74.2
Vau.		2	6	9		108			M*	M-	17	23	85	78.8

TABLE 20

A Comparative Test of American and European Grown Tulips of the Same Variety Forced Under Greenhouse Conditions

Variety Inglescombe Yellow

	Date Brot. in From Storage	Weekly Growth When Brot. in	Weekly Growth 1st. Week	Weekly Growth 2nd. Week	Days in Cool Room	Number of Bulbs	Date of First Bloom	Date of Last Bloom	Quality of Blooms	Quality of Foliage	Average Length of Stems	Number of Blind Bulbs	Total Number of Flowers	Percent of Bulbs Which Bloomed
Del.	2/10	5	11	19	7	10	3/21	3/21	2P	P	24	8	2	
Vau.		5	6	15	7	10				P	18	10	0	
Del.	2/17	6	10	16	14	15	4/2	4/2	1M	P	18	14	1	
Vau.		5	8	17	14	15	3/31	3/31	13 1P	P	19	13	2	
Del.	3/3	6	12	18	7	10				P	20	10	0	
Vau.		5	10	20	7	15	4/4	4/11	8M 2M1P	P+	32	4	11	
Del.	3/10	6	14	17	7	10	4/8	4/8	2M	P+	27	9	1	
Vau.		4	11	18	7	10	4/7	4/12	4M 1P	M	31	5	5	
Del.	3/17	6	15		7	10	4/14	4/14	1P	P+	27	9	1	
Vau.		5	12		7	5	4/13	4/13	1P	P	24	4	1	
Del.	4/12	17	23		0	10			0	P	26	10	0	
Vau.		11	20		0	10			0	P	27	10	0	
		App. Average			Total				App. Average			Total		
Del.		8	14	18	65				M-	P+	24	60	5	7.7
Vau.		7	11	18	65				M+	P+	25	46	19	29.2

Variety Inglescombe Yellow (Table 20)

This variety was a great disappointment for there is very little that can be said in favor of the American or European grown bulbs of this variety for forcing during the present year. The bulbs seemed to be of good quality and size but they were not well adapted to forcing. As shown in Table 20, the European bulbs were superior in quality of bloom, percent of bloom and length of stems. The bulbs which were planted outside were very desirable, both for the American and European grown.

Variety Cardinal Manning (Table 21)

The forcing quality of this variety was a great disappointment this year (1926), for as a general rule good success has been obtained. When the bulbs were brought in from storage they appeared to be of good quality, but for some reason they did not respond to forcing. Many of the flowers bloomed green or with little or no color and many failed to open. The American bulbs were superior in quality of bloom, length of stems and percent of bulbs to flower.

TABLE 21

A Comparative Test of American and European Grown Tulips of the Same Variety Forced Under Greenhouse Conditions

Variety Cardinal Manning

	Date Brot. in From Storage	Weekly Growth When Brot. in	Weekly Growth 1st. Week	Weekly Growth 2nd. Week	Days in Cool Room	Number of Bulbs	Date of First Bloom	Date of Last Bloom	Quality of Blooms	Quality of Foliage	Average Length of Stems	Number of Blind Bulbs	Total Number of Flowers	Percent of Bulbs Which Bloomed
Del.	2/10	5	6	18	7	8	3/15	3/15	10	G-	26	7	1	
Vau.		2	5	14	7	8				P	17	8	0	
Del.	3/3	6	12	18	7	12	4/3		20	P+	24	10	2	
Vau.		3	8	15	7	12	4/6		1M	M	26	11	1	
Del.	3/17	5	11	19	7	10	4/13	4/14	30	M	30	7	3	
Vau.		3	8	18	7	10	4/14	4/15	2P	M-	29	8	2	
Del.	4/12	12	18		0	4				P	25	3	0	
Vau.		9	14		0	5				P	20	5	0	
		App. Average				Total			App. Average			Total		
Del.		7	12	18		34			G	M-	26	29	6	17.6
Vau.		4	9	16		35			P+	M-	23	32	3	8.5

TABLE 22

A Comparative Test of American and European Grown Tulips of the Same Variety Forced Under Greenhouse Conditions

Variety Mon Tresor

	Date Brot. in From Stor-age	Weekly Growth When Brot. in	1st. Week	2nd. Week	Days in Cool Room	Number of Bulbs	Date of First Bloom	Date of Last Bloom	Quality of Blooms	Quality of Foli-age	Average Length of Stems	Number of Blind Bulbs	Total Number of Flow-ers	Percent of Bulbs Which Bloomed
Del.	2/17	6	11	12	14	54	3/19	3/9	16P	P-	12	39	15	
Vau.		3	9	10	14	54	3/1	3/10	50P	M	12	4	50	
Del.	3/10	3	8		7	54	3/15	3/27	27P	P	11	27	27	
Vau.		3	7		7	54	3/20	3/28	16P	P	13	38	16	
		App. Average				Total			App. Average			Total		
Del.		6	10	12		108			P	P-	12	66	42	38.8
Vau.		3	8	10		108			P	P+	13	42	66	61.1

Variety Mon Tresor (Table 22)

It seemed impossible to keep the bulbs of this variety from blooming, for as shown in Table 22, those of the American grown which were brought in from storage February 17th, were starting to bloom February 19th, or after a period of two days. Those which were brought in March 10th were blooming the fifth day. The European bulbs did not bloom so readily, but did not prove to be of any greater quality. A greater percent of the European bulbs bloomed.

Variety Mr. Barncombe Sanders (Table 23)

The American bulbs of this variety were, in general, a few days earlier in blooming. The foliage was also more desirable and the percent of blooming somewhat greater. The length of the flowering stems was greater for the European bulbs and the quality of blooms equal to the American grown.

TABLE 23

A Comparative Test of American and European Crown Tulips of the Same Variety Forced Under Greenhouse Conditions

Variety Mr. Farncombe Sanders

	Date Brot. in From Stor-age	Weekly Growth When Brot. in	1st. Week	2nd. Week	Days in Cool Room	Number of Bulbs	Date of First Bloom	Date of Last Bloom	Quality of Blooms	Quality of Foliage	Average Length of Stems	Number of Blind Bulbs	Total Number of Flowers	Percent of Bulbs Which Bloomed
Vos.	2/17	4	10	23	14	10	3/17	3/25	9G	G	33	1	9	
Vau.		2	6	25	14	10 (2 dead)	3/20	3/23	7G	G	38	1	7	
Vos.	3/3	5	9	23	7	5 (1 dead)	3/29	3/31	4G	G	41	0	4	
Vau.		4	9	21	7	22 (1 dead)	3/30	4/4	21G	G-	39	0	21	
Vau.	3/10	5	10	27	7	16	4/4	4/7	12G 3M 1P	G	39	0	16	
Vos.	3/17	4	6	16	7	10	4/8	4/12	9G 1P	G	37	0	10	
Vau.		2	7	18	7	20	4/9	4/12	9G 4M 1P	M	39	4	16	
		App. Average				Total			App. Average			Total		
Vos.		4	8	21		25			G-	G	37	1	23	92
Vau.		3	8	23		68			G-	G-	39	5	60	88.2

TABLE 24

A Comparative Test of American and European Grown Tulips of the Same Variety Forced Under Greenhouse Conditions

Variety Baronne de la Tonnaye

	Date Brot. in Storage	Weekly Growth: When Brot. in	1st. Week	2nd. Week	Days in Cool Room	Number of Bulbs	Date of First Bloom	Date of Last Bloom	Quality of Blooms	Quality of Foliage	Average Length of Stems	Number of Blind Bulbs	Total Number of Flowers	Percent of Bulbs Which Bloomed
Del.	2/17	3	4	14	14	5	3/20		1M	M	32	4	1	
Vos.		3	6	22	14	5	3/24	3/25	2G 1M	M	44	2	3	
Vau.		1	5	22	14	5	3/27	3/28	2G	M	45	3	2	
Del.	3/3	4	10	23	7	10	4/2	4/5	4G 1M	G	38	5	5	
Vos.		3	11	27	7	10	3/30	4/6	5G 4M	G	39	1	9	
Vau.		3	7	26	7	35	4/2	4/12	25G 2M 3P	G	44	14	21	
Del.	3/17	1	7	18	7	5				P	24	3	0	
Vau.		4	7	31	7	10	4/13	4/16	5G 1M 1P	M	42	3	7	
Del.	3/24	3	9	25	0	5	4/19	4/22	4G 1M	P	26	0	5	
Vos.		4	10	21	0	9	4/18	4/21	3G 4M	G	37	2	7	
Vau.		4	10	22	0	10	4/19	4/23	6G 2M	M+	44	2	8	
		App. Average:				Total			App. Average			Total		
Del.		3	8	20		25			G-	M-	30	14	11	44
Vos.		4	9	23		24			G-	G+	40	5	19	79.1
Vau.		3	7	25		60			G-	M+	44	22	38	63.3

Variety Baronne de la Tonnaye (Table 24)

There is considerable variation in this variety. As shown by Table 24, the quality of the blooms of the American grown bulbs (Del. and Vos.) and the European bulbs is practically the same. However, there is considerable variation in the foliage. The quality of the foliage corresponds with the percentage of bloom in each of the three cases. However, when an average is taken, the American grown bulbs are equal to the European.

Variety Gretchen (Table 25)

The quality of bloom, foliage, length of stems and percentage of blooms of the European bulbs are superior to the American grown. In many cases, however, the American bulbs seem to bloom somewhat earlier.

TABLE 25

A Comparative Test of American and European Grown Tulips of the Same Variety Forced Under Greenhouse Conditions

Variety Gretchen

	Date From Storage	Weekly Growth When Brot in	Weekly Growth 1st. Week	Weekly Growth 2nd. Week	Days in Cool Room	Number of Bulbs	Date of First Bloom	Date of Last Bloom	Quality of Blooms	Quality of Foliage	Average Length of Stems	Number of Blind Bulbs	Total Number of Flowers	Percent of Bulbs Which Bloomed
Del.	2/10	2	5	15	7	5	3/15	3/18	4G 1M	G	23	0	5	
Vos.		4	7	19	7	5	3/14	3/16	5G	G	24	0	5	
Vau.		2	4	14	7	5	3/15	3/19	4G 2M	G	25	0	5	
Del.	2/17	4	8	20	14	10	3/20	3/25	4G 3M	M	25	3	7	
Vos		3	6	22	14	9	3/22	3/25	7G 1M	M	28	1	8	
Vos.	3/3	5	11	20	7	10	3/29	4/3	2G 2M 1P	M	27	0	5	
Vau.		2	6	22	7	15	4/1	4/7	14G 1P	E	34	0	15	
Del.	3/10	6	13	23	7	13	4/3	4/8	4G 9M	M	29	0	13	
Vos.		5	12	20	7	5	4/6	4/8	4M	M	27	1	4	
Vau.		2	9	26	7	10	4/5	4/10	9G 1P	G	34	0	10	
Del.	3/17	3	10	18	7	5	4/12	4/14	2P	P	24	3	2	
Vau.		1	5	21	7	5	4/18	4/19	3M 2P	M	26	0	5	
Vos.	3/24	5	12	20	0	5	4/19	4/23	4M	M	25	1	4	
Vau.		2	7	19	0	10	4/20	4/23	4G 4M	G	30	2	8	
		App. Average				Total			App. Average			Total		
Del.		4	10	19		33			M+	M	25	6	28	84.8
Vos.		5	10	20		34			M+	M+	26	8	26	76.4
Vau.		2	6	25		45			G-	G	30	2	43	95.5

TABLE 26

A Comparative Test of American and European Grown Tulips of the Same Variety Forced Under Greenhouse Conditions

Variety Bartigon

	Date Brot. in From Storage	Weekly Growth When Brot. in	Weekly Growth 1st. Week	Weekly Growth 2nd. Week	Days in Cool Room	Number of Bulbs	Date of First Bloom	Date of Last Bloom	Quality of Blooms	Quality of Foliage	Average Length of Stems	Number of Blind Bulbs	Total Number of Flowers	Percent of Bulbs Which Bloomed
Vos.	2/17	3	7	23	14	5	3/21	3/22	5G+	G	34	0	5	
Vau.		3	7	24	14	10	3/21	3/22	10G	G	36	0	10	
Del.	3/3	6	11	20	7	10	3/25	4/4	9G	G	31	1	9	
Vos.		6	9	23	7	5	3/30	4/2	4G	G	36	1	4	
Vau.		5	10	24	7	10	3/30	4/3	7G1M1P	G	37	0	10	
		App. Average				Total			App. Average			Total		
Del.		6	11	20		10			G	G	31	1	9	90
Vos.		4	8	23		10			G+	G	35	1	9	90
Vau.		4	9	24		20			G-	G	37	0	20	100

Variety Bartigon (Table 26)

The American (Vos. and Del.) grown bulbs of this variety have superior quality of bloom. The quality of the foliage is the same, but the length of stems and percentage of bloom is greater for the European. The time of blooming was approximately the same.

Variety William Copland (Table 27)

The quality of the foliage and bloom of the American (Del.) and the European grown bulbs is of the same. Vos. (American) grown are inferior to the European. In general, the European bulbs of this variety are superior to the American grown.

TABLE 27

A Comparative Test of American and European Grown Tulips of the Same Variety Forced Under Greenhouse Conditions

Variety William Copland

	Date Brot. in From Storage	Weekly Growth When Brot. in	Weekly Growth 1st. Week	Weekly Growth 2nd. Week	Days in Cool Room	Number of Bulbs	Date of First Bloom	Date of Last Bloom	Quality of Blooms	Quality of Foliage	Average Length of Stems	Number of Blind Bulbs	Total Number of Flowers	Percent of Bulbs Which Bloomed
Vos.	2/10	4	9	14	7	5	3/10	3/19	2P	G	20	3	2	
Vau.		3	8	15	7	5	3/9	3/9	5G	G	27	0	5	
Del.	2/17	5	9	14	14	10	3/14	3/17	6G 2M	G	28	2	8	
Vos.		5	10	17	14	10	3/16	3/17	7G 3M	G	29	0	10	
Vau.		4	8	18	14	20	3/14	3/17	19G 1M	G	30	0	20	
Del.	3/3	7	12	19	7	5 (2dand)	3/29	3/31	3G	G	34	0	3	
Vos.		4	10	20	7	5	3/30	4/2	2G 2M	G	34	1	4	
Del.	3/10	7	15	26	7	15	4/1	4/4	12P	G-	31	3	12	
Vos.		6	14	20	7	5				P-	22	5	0	
Vau.		6	14	28	7	30	4/1	4/6	18G 3M	G-	35	9	21	
Vos.	3/17	3	7	18	7	10	4/9	4/12	3M 3P	M-	27	4	6	
Vau.		5	11	23	7	15	4/7	4/10	13G	G	38	2	13	
		App. Average				Total			App. Average			Total		
Del.		6	12	30		30			G-	G-	31	5	23	76.6
Vos.		5	10	18		35			M	M	27	13	32	62.8
Vau.		5	10	21		70			G-	G-	33	11	59	82.4

TABLE 28

A Comparative Test of American and European Grown Tulips of the Same Variety Forced Under Greenhouse Conditions

Variety La Tulip Noire

	Date Brot. in From Stor-age	Weekly Growth When Brot. in	1st. Week	2nd. Week	Days in Cool Room	Number of Bulbs	Date of First Bloom	Date of Last Bloom	Quality of Blooms	Quality of Foli-age	Average Length of Stems	Number of Blind Bulbs	Total Number of Flow-ers	Percent of Bulbs Which Bloomed
Vos.	2/10	8	12	18	7	10	3/10	3/15	8M	G	23	2	8	
Vau.		1	7	15	7	5	3/9		1M	P	30	4	1	
Del.	2/17	6	10	20	14	5	3/20	3/22	3G	G	37	2	3	
Vos.		9	19	22	14	5	3/17	3/30	5G	G	30	0	5	
Vau.		4	8	22	14	10	3/20	3/22	7G 2M 1P	G	33	0	10	
Vos.	3/3	7	12	18	7	5	3/31	4/2	5G	G	27	0	5	
Vau.		5	10	22	7	5	3/31	4/3	3G 2M	G	37	0	5	
Vos.	3/10	9	17	29	7	5	4/2	4/5	3G 2M	G	36	0	5	
Vau.		9	17	25	7	5	4/3	4/6	2G 2M	G	32	0	5	
		App. Average				Total			App. Average			Total		
Del.		6	10	20		5			G	G	37	2	3	60
Vos.		8	15	22		25			G-	G	29	2	23	92
Vau.		5	11	21		25			M+	G-	33	4	21	84

Variety La Tulip Noire (Table 28)

There is considerable variation in the results within this variety. As shown by Table 28, the American grown bulbs are superior to the European. The length of stems and percentage of blooms are approximately the same. The greatest objection to this variety was that often times two or three flowers would develop on one stem.

TABLE 29

A Comparative Test of American and European Grown Tulips of the Same Variety Forced Under Greenhouse Conditions

Variety Apricot

	Date Brot. in From Storage	Weekly Growth When Brot. in	1st. Week	2nd. Week	Days in Cool Room	Number of Bulbs	Date of First Bloom	Date of Last Bloom	Quality of Blooms	Quality of Foliage	Average Length of Stems	Number of Blind Bulbs	Total Number of Flowers	Percent of Bulbs Which Bloomed
Del.	2/10	5	9	20	7	8	3/14	3/18	3M*	C-	32	5	3	
Vau.		4	8	19	7	8	3/15	3/18	5M	C	39	3	5	
Del.	2/17	5	11	23	14	8	3/20	3/23	3C 1 double	C-	31	4	4	
Vau.		6	11	23	14	8	3/22	3/25	2C	C-	36	6	2	
Del.	3/3	7	14	21	7	8	4/3	4/6	2C 1M 3P	M	30	3	5	
Vau.		6	12	17	7	8	4/3	4/4	3C	M	24	5	3	
Del.	3/10	6	16	28	7	4	4/6	4/7	3C	M*	40	1	3	
Vau.		6	18	28	7	8	4/6	4/8	2C	M	42	6	2	
		App. Average				Total			App. Average			Total		
Del.		6	13	23		25			C-	M*	33	13	15	53.5
Vau.		6	12	22		32			M*	M*	35	20	12	37.5

Variety Apricot (Table 29)

This variety did not prove to be as good for forcing this year (1926) as it has in previous years. Although the quality of blooming, time of blooming and percentage of bulbs to flower are greater for the American grown, there was a tendency for the Americans to produce several flowers per stem. Such a condition is very undesirable. The foliage of both the American and European was slightly damaged by tip-burning.

Variety Golden Bronze (Table 30)

The European bulbs of this variety were much superior to the Americans in quality of bloom, foliage, length of stems and total percent of bulbs to flower. Although the European bulbs were damaged somewhat by tip-burning, they were much less so than the American. There was also a tendency for the American bulbs to produce several flowers per stem which is very undesirable.

TABLE 30

A Comparative Test of American and European Grown Tulips of the Same Variety Forced Under Greenhouse Conditions

Variety Golden Bronze

	Date From Storage	Date Brot. in	Weekly Growth When Brot.	Weekly Growth 1st. Week	Weekly Growth 2nd. Week	Days in Cool Room	Number of Bulbs	Date of First Bloom	Date of Last Bloom	Quality of Blooms	Quality of Foliage	Average Length of Stems	Number of Blind Bulbs	Total Number of Flowers	Percent of Bulbs Which Bloomed
Del.	2/10	8	11	18	7	10					M	20	10	0	
Vau.		6	12	21	7	15	3/10	3/15	4G 4M 1P		G-	30	6	9	
Del.	2/17	10	13	21	14	8	3/20		1M		M-	26	7	1	
Vau.		7	11	24	14	10	3/17	3/20	4G 2M 1P		M	34	3	7	
Del.	3/10	8	18	27	7	15 (1 dead)	3/30	4/3	12P		M	37	2	12	
Vau.		7	18	30	7	15	3/30	4/4	3G 8M 1P		M	37	3	12	
		App. Average				Total				App. Average			Total		
Del.		9	14	22		33				P	M-	28	19	13	39.3
Vau.		7	14	25		40				M+	M+	34	12	28	70.0

TABLE 31

Best Date for Forcing Tulips

Name of Variety	Am. of Bur.	Date Forced	Date of First Bloom	Quality of Bloom	Quality of Foli-	Number of Bulbs	Number of Blooms
	Del.	3/3	3/29	4G	G	4	4
Bacchus	Vau.	2/17	3/17	8G+	G+	8	8
	Del.	2/10	2/27	31G 23P	M	58	58
Fred Moore	Vau.	2/17	3/11	5G-	G	5	5
Inglescombe	Del.	2/17	3/20	10G	P+	10	10
Pink	Vau.	3/3	3/29	12G 2M	M	25 (4 dead)	14
	Del.	3/3	3/20	15G	G	15	15
Peach Blossom	Vau.	3/3	3/20	12G 2P	G	15	14
Couleur	Del.	3/3	4/2	20G 24M 6P	M	54	50
Cardinal	Vau.	3/3	4/1	46G 8M	G	54	54
	Del.	3/10	4/6	2G	M	5	2
Turenne	Vau.	3/10	4/8	4G	M	5	4
	Del.	3/10	4/6	3G	M+	4	3
Apricot	Vau.	3/3	4/3	3G	M	8	3
	Del.	3/10	3/30	12P	M	15 (1 dead)	12
Golden Bronze	Vau.	3/10	3/30	3G 8M 1P	M	15	12
	Del.	2/17	3/18	8G	M	10	8
Picotee	Vau.	2/17	3/19	9G 1M	M-	10	10
	Del.	2/10	2/22	48M	P	54	48
White Hawk	Vau.	3/10	3/30	20G 15M	M	54	35
Inglescombe	Del.	3/10	4/6	1G	P+	10	1
Yellow	Vau.	3/3	4/4	5G 5M 1P	P+	15	11
Cardinal	Del.	3/17	4/13	3G	M	10	3
Manning	Vau.	3/17	4/14	2P	M-	10	2
Mr. Farncombe	Vos.	3/3	3/29	4G	G	5 (1 dead)	4
Sanders	Vau.	3/3	3/30	21G	G-	22 (1 dead)	21
	Vos.	2/17	3/22	9G 5M	M-	15	14
Clara Butt	Vau.	2/10	3/14	17G 2P	G	20	19
	Del.	3/24	4/19	4G 1M	P	5	5
Baronne de la	Vos.	3/3	3/30	5G 4M	G	10	9
Tonnaye	Vau.	3/24	4/19	6G 2M	M+	10	8
	Del.	3/10	4/3	4G 9M	M	13	13
	Vos.	3/3	3/29	2G 2M 1P	M	10	5
Gretchen	Vau.	3/24	4/20	4G 4M	G	10	8
	Del.	3/17	4/7	6G 2M	M	10	8
Pride of	Vos.	3/17	4/9	4G 1P	M+	5	5
Haarlem	Vau.	3/10	4/4	10G 2M 1P	G	15 (1 dead)	13
	Del.	2/17	3/14	6G 2M	G	10	8
	Vos.	2/17	3/15	7G 3M	G	10	10
Wm. Copland	Vau.	2/17	3/14	19G 1M	G	20	20

TABLE 31 (Continued)

Best Date for Forcing Tulips

Name of Variety	Am. or Eur.	Date Forced	Date of First Bloom	Quality of Bloom	Quality of Foliage	Number of Bulbs	Number of Blooms
	Del.	2/17	3/20	3G	G	5	3
	Vos.	2/17	3/17	5G	G	5	5
La Tulip Noire	Vau.	2/17	3/20	7G 2M 1P	G	10	10
Reverend Ewbank	Vau.	3/10	3/23	4G	M	5	4
Murillo	Vau.	3/24	4/10	20G 5M 1P	G	25	26
Flamingo	Vau.	3/10	3/25	10G	G	10	10
Parrot Mixed	Vau.	3/17	4/12	3G	P	5	3
Bizarres	Vau.	3/10	4/5	3G 6M	M	10	9
Bybloemen	Vau.	3/10	4/5	3G 2M	G	5	5
Couronne d'Or	Vau.	2/17	3/12	8G 8M	M+	16	16

The best date for forcing tulips varied greatly, not only with different varieties of tulips but also with bulbs of the same variety of similar origin. Table 31 gives in detail a record of the best date of forcing.

No direct conclusions can thus be drawn from one year's study of the many varieties as to the best date for forcing. Weather conditions, date of planting, storage conditions and where the bulbs are grown will largely determine the date of flowering.

TABLE 32

Results of the Second Year's Growth of American and European Grown Tulips Under Garden Conditions

Name of Variety		No. of Bulbs	No. Dead Bulbs	Date of First Bloom	Date of Last Bloom	Quality of Bloom	Quality of Foliage	Av. Length of Stem	No. of Blind Bulbs	Total No. of Flowers	Percent of Bloom Per Bulb	No. and Quality of Bulbs Produced
Prince of Austria	Am.	5	0	4/25	5/2	P	P	15	2	3	60	4M 3P 13B
	Eu.	5	1	4/26	4/28	P	P	17	0	4	80	4P 2B
Baron de la Tonnaye	Am.	6	0	5/8	5/9	G	M	19	1	5	83.3	9M 7P 20B
	Eu.	6	0	5/8	5/8	G	M	18	4	1	16.6	3P 31B
Turenne	Am.	6	0	5/8	5/10	G	M*	30	3	3	50	3M 4P 11B
	Eu.	6	0	5/10	5/12	M	M*	28	0	6	100	6M 7P 13B
Couronne d'Or	Am.	6	1	4/27	4/30	P	P	16	4	2	33.3	2P
	Eu.	6	0	4/25	4/27	M*	P	17	0	6	100	4P 11B
Panorama	Am.	6	0	5/2	5/9	M	G	26	0	6	100	14M 2P 18B
	Eu.	6	0	5/2	5/9	M	G	25	1	5	83.3	8M 5P 12B
La Reine	Am.	2	0				P	11	2	0	00	3P 3B
	Eu.	8	0	4/25	4/27	M	P	15	6	2	25	6M 5P 10B
Artus	Am.	3	0	5/2	5/2	M	P	7	1	2	66.6	3P 6B
	Eu.	6	0				P	?			00	9P- 17B
Keizers-Kroom	Am.	9	0	4/21	4/26	P	P	21	3	6	66.6	7M 14P
	Eu.	9	0	4/23	4/27	P*	P	20	3	6	66.6	6P 13B
Couleur Cardinal	Am.	20	0	4/25	4/29	P	P	16	15	5	25	17P 13B
	Eu.	25	1	4/28	5/2	P	P	14	16	4	16	14P 9B
Dream	Am.	23	6				P	13	17	0	00	2M 10P 25B
	Eu.	16	7	5/6	5/7	G	P*	32	6	3	18.7	4M 9P 12B

The results of the second year's growth of American and European grown tulips under garden conditions varied greatly with the many varieties. As indicated in Table 32, the quality of the blooms, foliage and length of stems for many of the varieties were practically the same for American and European bulbs.

Although all of the varieties of the American grown tulips did not respond well to the second year's growth, many varieties of the American bulbs were superior to the European varieties. Conclusions from this table suggest that many varieties of American grown tulips will respond favorably to bulb and flower production but for good success special attention should be given to only those varieties which will compare well to European grown.

TABLE 33

Approximate Average and Total Results of All Forced Tulips

Name of Variety	European or American	Weekly Growth When Brot. in (cm.)	Weekly Growth 1st. Week (cm.)	Weekly Growth 2nd. Week (cm.)	Number of Bulbs	Quality of Blooms	Quality of Foliage	Average Length of Stem (cm.)	Number of Blind Bulbs	Total Number of Blooms	Percent of Bulbs Bloomed
Bacchus	Del.	9	14	25	25	G-	G-	35	1	24	96.
	Vau.	7	14	25	20	G	G	35	0	20	100.
Fred Moore	Del.	4	8	12	77	M+	M+	20	2	75	97.4
	Vau.	3	6	18	69	M+	G-	21	1	68	98.5
Inglescombe Pink	Del.	6	14	23	60	G-	M	35	10	50	83.3
	Vau.	4	11	22	60	G-	M	37	21	34	56.6
Peach Blossom	Del.	5	8	17	60	G-	G-	22	1	59	98.3
	Vau.	4	8	16	60	M+	G-	21	5	53	88.3
Couleur Cardinal	Del.	5	12	17	112	M+	M	21	9	104	92.8
	Vau.	4	8	13	121	G-	G-	19	10	111	91.6
Turenne	Del.	7	18	27	32	G-	F+	37	22	10	31.2
	Vau.	4	9	23	40	G-	M	34	18	22	55.
Apricot	Del.	6	13	25	28	G-	M+	32	13	15	53.5
	Vau.	6	12	22	32	M+	M+	35	20	12	37.5
Golden Bronze	Del.	9	14	22	33	F	M-	28	19	13	39.3
	Vau.	7	14	25	40	M+	M+	34	12	28	70.
Picotee	Del.	6	13	26	20	M+	M	36	4	16	80.
	Vau.	6	10	24	20	M+	M-	36	0	20	100.
White Hawk	Del.	5	7	11	108	M	F+	18	28	80	74.2
	Vau.	2	6	9	108	M+	M-	17	14	85	78.8
Inglescombe Yellow	Del.	8	14	18	65	M-	F+	24	60	5	7.7
	Vau.	6	11	18	65	M+	F+	25	46	19	29.2
Cardinal Manning	Del.	7	12	18	34	G	M-	26	29	6	17.6
	Vau.	4	9	16	35	F+	M-	23	32	3	8.5
Mr. Farncombe Sanders	Vos.	4	8	21	25	G-	G	37	1	23	92.
	Vau.	3	8	23	68	G-	G-	39	5	60	88.2

TABLE 33 (Continued)

Approximate Average and Total Results of All Forced Tulips

Name of Variety	European or American	Weekly Growth When Brot. in (cm.)	Weekly Growth 1st. Week (cm.)	Weekly Growth 2nd. Week (cm.)	Number of Bulbs	Quality of Blooms	Quality of Foliage	Average Length of Stem (cm.)	Number of Blind Bulbs	Total Number of Blooms	Percent of Bulbs Bloomed
	Dom.	4	10	16	30	M+	M	26	10	20	66.6
Clara Butt	Vau.	4	9	17	60	M+	M+	37	4	56	93.3
	Dom.	3	8	20	25	G-	M-	30	14	11	44.
Baronne de la Tonnaye	Vos.	4	9	23	24	G-	G+	40	5	19	79.1
	Vau.	3	7	25	60	G-	M+	44	22	38	63.3
	Dom.	4	10	19	33	M+	M	25	6	38	84.8
	Vos.	5	10	20	34	M+	M+	26	8	26	76.4
Gretchen	Vau.	2	6	25	45	G-	G	30	2	43	95.5
	Dom.	5	13	25	40	G	M+	32	16	22	55.
	Vos.	4	10	22	28	M	M	33	16	9	36.
Pride of Haarlem	Vau.	4	11	21	40	M-	M-	29	26	13	32.5
	Dom.	6	12	20	30	G-	G-	31	5	23	76.6
	Vos.	5	10	18	35	M	M	27	13	22	62.8
Wm. Copland	Vau.	5	10	21	70	G-	G-	33	11	59	82.4
	Dom.	6	10	20	5	G	G	37	2	3	60.
	Vos.	8	15	22	25	G-	G	29	2	23	92.
La Tulip Noire	Vau.	5	11	21	25	M+	G-	33	4	21	84.

Table 33 is arranged to give in general a summary of all forced tulips of American and European grown bulbs forced under greenhouse conditions. In many cases it becomes exceedingly hard to determine which is superior, the American or European, because so many variable factors must be taken into consideration.

Of the nineteen varieties of tulips which were forced for a comparative test under greenhouse conditions, five of the American varieties produced blooms of superior quality; six European varieties were more desirable and for eight varieties little or no difference could be detected between the American and European grown bulbs of corresponding varieties.

The foliage of the European bulbs was more free from disease. In only four varieties of the nineteen did the American bulbs produce foliage superior to the European grown. In eight varieties the foliage of the European bulbs was more desirable and in seven varieties the quality of the foliage was considered the same.

The length of stems for American and European bulbs was practically the same for most varieties.

TABLE 34

Results of Garden Grown Tulips

Name of Variety		Number of Bulbs	Date of First Bloom	Date of Last Bloom	Quality of Blooms	Quality of Foliage	Average Length of Stems	No. of Blind Bulbs	Total Number of Flowers	Percent of Blooms Per Bulb
	Del.	16	5/15	5/10	F+	G	27	2	14	87.5
	Vos.	15	5/8	5/10	F	F	23	1	14	93.3
Cretchen	Vau.	29	5/8	5/15	M	M+	30	1	34	117.2*
	Del.	16	5/5	5/10	M-	G	38	4	12	75.
Baronne de la	Vos.	15	5/8	5/11	M+	G	34	0	15	100.
Tonnaye	Vau.	26	5/10	5/15	G	G	39	15	11	42.3
	Del.	26	5/8	5/9	M+	M	30	0	26	100.
Inglescombe Pink	Vau.	15	5/7	5/9	G-	M+	35	0	15	100.
Inglescombe	Del.	26	5/8	5/14	G-	M+	30	5	21	80.7
Yellow	Vau.	23	5/8	5/14	M+	M-	28	5	18	78.2
	Del.	25	5/1	5/8	G-	F	18	1	24	96.
Couleur Cardinal	Vau.	24	4/30	5/5	G	F	18	0	24	100.
	Del.	11	5/4	5/8	G-	M+	26	0	11	100.
Reverend Ewbank	Vau.	15	5/4	5/7	G	G	46	0	15	100.
	Del.	14	5/3	5/6	G	G	40	2	12	85.7
Turenne	Vau.	15	5/10	5/13	G	M	31	3	12	80.
	Del.	25	4/30	5/4	G-	F+	17	0	25	100.
Peach Blossom	Vau.	27	5/2	5/4	G-	F	12	1	26	96.3
	Del.	31	5/7	5/9	G-	M+	33	3	28	90.3
Pride of Haarlem	Vau.	40	5/5	5/9	M+	G	37	3	37	92.5
	Del.	24	5/5	5/8	M-	M	32	7	44	183.3*
Apricot	Vau.	17	5/8	5/11	G-	M+	23	0	17	100.
	Del.	22	5/2	5/5	G-	M	23	6	16	72.7
Fred Moore	Vau.	24	5/1	5/4	G-	F	22	0	24	100.

*Many doubles

TABLE 34 (Continued)

Results of Garden Grown Tulips

Name of Variety		Number of Bulbs	Date of First Bloom	Date of Last Bloom	Quality of Blooms	Quality of Foliage	Average Length of Stems	No. of Blind Bulbs	Total Number Of Flowers	Percent of Blooms Per Bulb
Mon Tresor	Del.	13	4/28	5/3	M*	P	15	0	13	100.
	Vau.	26	4/27	5/4	M*	P	17	1	25	96.1
White Hawk	Del.	30	4/26	5/4	M-	P	17	14	16	53.3
	Vau.	27	4/23	5/5	M-	P	14	3	24	88.8
Clara Butt	Vos.	13	5/8	5/10	G	M	31	3	10	76.9
	Vau.	13	5/6	5/8	G-	G	35	0	13	100.
William Copland	Del.	25	5/3	5/9	G	G	39	2	23	92.
	Vos.	15	5/9	5/10	P	P	24	10	5	33.3
Farncombe Sanders	Vos.	15	5/4	5/9	G	G	30	4	11	73.3
	Vau.	36	5/5	5/9	G-	G	38	4	32	88.8
Golden Bronze	Del.	27	5/2	5/7	M	M*	33	8	45	166.6*
Picotee	Del.	27	5/3	5/9	G-	G	33	0	27	100.
Cardinal Manning	Del.	18	5/7	5/10	G	M*	40	5	13	72.1
Murillo	Vau.	41	4/26	5/4	G-	P-	18	1	40	97.5
Flamingo	Vau.	36	4/26	5/1	G-	M	16	2	34	94.4
Couronne d'Or	Vau.	41	5/1	5/5	G-	P	20	2	39	95.1
La Tulip Noire	Vau.	32	5/5	5/9	G-	G	33	0	36	112.5*
Bacchus	Vau.	14	5/4	5/8	M*	M*	36	0	14	100.
Mrs. Mote	Am.	81	5/4	5/10	G	G-	36	4	77	96.3

* Many doubles

Results of Garden Grown Tulips

In the fall of 1925 tulips of twenty-five varieties were planted in the Formal and Annual Gardens among the peonies and iris. Planting the tulips in this particular place provided a permanent and desirable location. The soil was of good texture and quality and bulbs planted in such a place could remain for future study and at the same time add interest to the garden. These tulips were not planted in rows but were planted in groups of several bulbs each, the number in each case depending on the number of bulbs of the variety. In each case, however, bulbs representing American and European grown were planted in as near the same conditions as possible.

In general, the results from the garden grown tulips were exceedingly good. The percent of bulbs to bloom was considerably higher than those forced under greenhouse conditions.

As shown in Table 34, four varieties produced more than 100 percent blooms. However, such a condition is undesirable for in each case the blooms would have been larger and of more desirable quality if only one flower had been produced per bulb.

There was not a direct comparison for all varieties because it was impossible to obtain bulbs of American and European grown stock of each variety.

TABLE 38

Forced Tulips Replanted In Garden

Name of Variety	Number of Bulbs	Date of First Bloom	Date of Last Bloom	Quality of Blooms	Quality of Foliage	Average Length of Stems	Number of Blind Bulbs	Total Number of Flowers	Percent of Blooms Per Bulb
Attraction	17	5/5	5/8	M+	M	30	0	17	100
La Victoire	10	5/2	5/8	M+	P	?	1	9	90
Chrysolora	17	5/1	5/4	G-	P	25	3	14	93.5
Pride of Haarlem	32	5/1	5/12	M+	M	30	6	26	81.2
Prince of Austria	11	5/1	5/6	G	P	27	8	3	27.2
Cottage Maid	27	4/30	5/5	M+	P	9	5	22	82.2
LaReine	32	4/28	5/5	M+	P-	16	6	26	81.2
Panorama	13	5/8	5/10	G-	M	24	7	6	46.1
Artus	24	5/1	5/5	M	P	19	10	14	58.3
Clara Butt	13	5/8	5/12	M-	P	25	9	4	30.7
White Hawk	26	4/26	5/9	M+	P	14	10	16	61.5
Couleur Cardinal	13	4/30	5/2	G	P	20	8	5	38.4
Keizerskroon	24	4/26	5/4	M+	M	26	6	18	75
Black Diamond	12	5/9	5/10	M	P	23	7	5	41.6
Rembrandt	13	5/5	5/16	M	M	20	8	5	38.6

Forced Tulips Replanted in Garden

From a review of bulb culture but very little information has been found where data in a direct form has been recorded on bulbs which have been forced under greenhouse conditions and replanted out under field conditions for future study. However, a few references seemed to indicate that after bulbs have once been forced they are of little value for forcing until after they have been planted and for one or more seasons.

The greatest reason why so little information has been published on this subject is because the American people have been able to obtain bulbs from Europe so cheaply that such a question has been given little or no consideration.

It was for the above reasons that in the spring of 1925 bulbs were saved from the forced tulips which were sold as cut flowers. These bulbs were then allowed to grow for several days and were then placed under the greenhouse benches where they were allowed to dry and cure off gradually. The bulbs remained in this condition until early spring. They were then cleaned and stored in a cool dry place until fall when they were planted out under the same conditions as the bulbs which had not been forced. There were no records recorded on the source of these bulbs but bulbs of both the American and European grown of the same variety were planted

together.

The results which were obtained are formulated in Table 35. Although the quality of bloom, foliage, length of stems and percentage of blooms are not equal to those which had not been forced, they were of much greater quality and substances than was expected.

In general, the flowers produced compared with the flowers of the non-forced more closely than did the foliage of the forced tulips with the foliage of the non-forced. Such results seem to indicate that tulip bulbs once forced should not be discarded but should be replanted for naturalizing effects or used for propagating stock.

GENERAL DISCUSSION

From the evidence based on the results of one year's experiments as described in this treatise, and from the experiments and observations of others, it seems fairly conclusive that there are great possibilities for the bulb industry in the United States.

The main reason why evidence based on a few years' results cannot be taken for granted is because bulbs of different varieties and bulbs of the same varieties, unless handled under identical conditions will vary greatly from year to year. The source of the bulb supply and knowledge of the cultural conditions are of vital importance. Also general observations and measurements show that bulbs planted and forced under greenhouse and garden conditions vary greatly not only with different varieties but with bulbs of the same variety grown in different localities.

The evidence concerning the quality of blooms of American and European grown bulbs is not believed to be entirely due to climatic conditions, but also largely to method of storing, cleaning, and handling from the time the bulbs are dug until they are delivered to the planter.

The methods of packing and the material in which the bulbs are packed vary greatly for the many companies from which bulbs were obtained. For this reason due credit must be given

to the European growers, for in the majority of cases the bulbs which were imported from Holland arrived in good condition even though they had been in transit for a much longer period.

The question of grading and cleaning is of great importance for American grown bulbs from many growers lacked uniformity of size and were not free from dead roots and soil.

Bulbs of the same variety also varied greatly in shape and color for the many companies from which the bulbs were obtained. The reason for such variations is thought to be primarily one of moisture and soil conditions, although many other factors may be responsible.

As stated in the summary of various tables, a great percentage of American grown tulip bulbs showed more symptoms of disease. Such a statement does not necessarily mean that the American bulbs are more susceptible to disease, but indications are that less grading had been done before shipping.

From the results of all tulips and narcissus which have been grown for experimental purposes,during the writer's observation and study, the greatest question concerning the bulb grower is not one of growing many varieties but one of selecting a few varieties which are well adapted to local conditions. A careful study and practice should also be made in grading and packing such bulbs.

CONCLUSIONS

1. American and European grown narcissus bulbs forced equally well under greenhouse conditions.
2. The time of blooming for narcissus was slightly earlier for the American grown.
3. The best date for forcing narcissus was from March 3rd to March 10th.
4. American narcissus planted under garden conditions flowered and produced bulbs of equal quality to the European grown.
5. American and European grown tulips forced equally well.
6. There was no noticeable differences in the flowering quality of American and European grown tulips under garden conditions although the American grown were more diseased.
7. Greenhouse forced tulips will respond favorably to replanting under garden conditions.
8. American grown bulbs at the present time are seldom graded with as much skill and care as European grown bulbs.
9. Certain localities of the United States are well adapted to the productions of narcissus and tulip bulbs.

Plate 1 Variety Gretchen

M8, O8, N8 American grown (Vos.). Date of blooming March 29; quality of bloom good; quality of foliage medium; 3 blind, 12 blooms.

N9, M9, O9 European grown. Date of blooming April 4; quality of bloom medium to poor; quality of foliage good; many flowers were produced per bulb.

Plate 2 Variety Pride of Haarlem

1N, 3N American grown (Del-Bay). Date of blooming April 4; quality of blooms good; quality of foliage good; 3 blind bulbs.

2N, 4N European grown. Date of blooming April 4; quality of blooms good; quality of foliage good; 1 blind bulb.

Plate 3 Variety Golden Bronze

1I, 3I, 5I American grown (Del-Bay). Date of blooming March 30; quality of blooms medium; quality of foliage poor; 2 blind bulbs, 13 blooms; foliage diseased; many undeveloped buds.

2I, 4I, 6I European grown. Date of blooming April 1; quality of blooms good; quality of foliage good; 2 blind bulbs, 13 blooms.

Plate 4 Variety Inglescombe Pink

N6, Q6, R6 American Grown bulbs (Del-Bay). Date of blooming, April 4; quality of blooms, medium; quality of foliage, medium; 1 blind bulb, 14 blooms.

N7, O6, R7 European Grown bulbs. Date of blooming, March 1; quality of blooms, medium; quality of foliage, medium; 1 blind bulb, 14 blooms.

Plate 5 Variety Bartigon

I8, J9, K9 American grown (Del-Bay). Date of blooming, March 30; quality of blooms, good; quality of foliage, good; 2 blind bulbs, 13 blooms.

I9, K8 European grown. Date of blooming, March 3[illegible]; quality of blooms, good; quality of foliage, good; 2 blind bulbs, 8 blooms.

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PART II

GROWTH STUDIES OF THE GLADIOLUS

TABLE OF CONTENTS

Part II

INTRODUCTION

The gladiolus, which is a cormaceous plant belonging to the family Iridaceae, has become very popular and made great progress during recent years. Such progress has largely been brought about through the interest of botanists, plant breeders and practical flower growers of the last few centuries. Hybridizing has so improved the flower in color, form, quality, size and substance that few flowering plants are of more interest and value to amateurs and florists.

As stated by Beal (3), that among the many summer blooming plants there are few, if any, which have made more rapid progress in popularity and favor in recent years than have the gladiolus.

The history of the gladioli, as stated by Allenwood (5), can be traced back to South Africa, although he believes there may have been a few species which have originated in eastern Europe and western Asia.

Through the influence of plant breeders who have of late years taken much interest in the gladiolus, The American Gladiolus Society was organized on the 27th of May, 1910, at Boston, Massachusetts.

The purpose of such an organization, according to (2), is to aid in stimulating interest and promoting the culture and development of the gladiolus, to establish a standard

nomenclature, to test out new varieties and to give them such recognition as they deserve, to study the diseases of the gladiolus and find remedies for same, to disseminate information relating to this flower, to secure uniformity in awarding prizes at flower shows, and to give one exhibition each year".

Because of the many pleasing colors and the wide adaptation of this plant, it is now necessary that proper recognition be given the flower that it may long continue to develop and improve.

ECONOMIC IMPORTANCE OF THE GLADIOLUS INDUSTRY

Not only have amateurs appreciated the great development of such a desirable flowering plant but through such development it is now being forced in greenhouses and grown as a commercial cut flower and is greatly appreciated by the buying public.

Thus Massey (8) quotes Hendrickson (1911) as saying, "There are from four hundred to five hundred acres in the United States devoted to gladioli, the annual production of corms being from 14,000,000 to 15,000,000 and the estimated value of the crops $250,000." These figures as given, he (8) believes, represents only a very small portion of the output of the United States, for almost every florist is more or less interested in growing a few for retailing purposes for which no records are kept.

Many trial gardens have been developed during the last few years and have caused much additional interest in this industry. Thus, according to Kunderd (7), "The Kunderd trial grounds at Goshen, Indiana, are without question, the most extensive of any devoted to the growing of gladioli. It is quite usual to find from 7,000 to 10,000 varieties growing separately; 40,000 select kings growing in mixture; 300,000 seedlings (all different) and an additional 1,000,000 new seedlings (also all different) coming on from seed."

The figures as given above represent only a minor portion of the gladiolus which are being grown at the present time, for the greatest increase in the development of the gladiolus has taken place during the last ten years.

At the present time, as indicated from the available literature on the gladiolus and its culture, there are many questions which cannot be answered which are of commercial interest. For this reason, the writer wishes to present in this treatise results which have been determined through one year's work and study.

THE EFFECT OF PLANTING AT INTERVALS ON THE TIME OF BLOOMING, SIZE AND QUALITY OF FLOWERS AND CORMS PRODUCED

Commercial growers are becoming more interested in the gladiolus not only as a greenhouse crop but also because if proper varieties are selected and planted at intervals of a few days, the blooming period of such a flower may be prolonged. This fact, that the blooming period can be prolonged, has not received the proper attention that it should, for little or no scientific information is available. However, the fact that such a condition is true does not necessarily prove that it is beneficial for the formation of more desirable corms and flowers produced, nor does such a statement indicate that corms planted at intervals of one week will bloom at corresponding intervals.

Some growers are of the opinion that gladiolus corms which may be started in greenhouses or cold frames in early spring and transplanted to the field mature much larger corms and will flower earlier than those planted in the field in early spring.

Thus Davis (4) states that, "Gladiolus bulbs that are started early in the greenhouse and get properly watered, with about the same temperature in which carnations grow, can be made to produce much larger bulbs than those planted out doors. Early planting does not produce flowers sooner than those planted later, when the ground is fit and warm enough to start growth. The growth of the bulb really starts from about the same time the first flower begins to open, and by giving them a start in the greenhouse, their growing season is made that much longer. The flower spike will come earlier, and if this is cut, they could have anywhere from three to four weeks longer growth in the field. This is what adds not only size to bulb, but an increase quality of corms."

According to (1), gladiolus corms may be planted as late as July 10. The reason for such late planting is because the flowers from such planting will come in season when there is a decline in the quality and amount of flowers on the market.

The time of planting as stated by Ellenwood (5), may be at any time from the first of May until the middle of

June. The date of planting should be timed with reference to variety and the time one desires the flowers. "Weather conditions influence the length of time required for blooming, as does the size of corms planted."

Hottes (6) alludes to early planting as follows: "When possible, a succession of bloom should be planted, the corms being planted in lots every week or ten days until July. In this way an excellent yield of blooms from a favorite variety may be obtained throughout the season."

MATERIAL AND METHODS

Material

The material which was used in making a growth study of the gladiolus consisted of nineteen commercial varieties of fifty corms each which had been grown by the Department of Horticulture the previous year.

The corms were stored during the previous winter in the fruit storage cellar on the Horticulture farm. The temperature of this cave varied from 35 to 40 degrees, but in general was very constant.

The place which was devoted to their culture was the southwest corner of the college test garden. This location was desirable because the soil was a good rich sandy garden loam and the site was well protected.

Methods

April 22, 1926, fifty corms of each of nineteen varieties of gladiolus were graded out from the general supply. Care was taken that corms of about an average size were selected.

April 23, ten corms of each variety were taken at random from those selected. The corms were then weighed, measured and planted.

Eight days later, May 1, ten more corms of each of the varieties were measured, weighed and planted. In like

manner five plantings were made at weekly intervals.

The method of planting was duplicated as nearly as possible for each date of planting. The corms were planted in rows ten feet long, one and one-half feet apart, two varieties to each row. All corms were placed five inches apart and at a depth of about four inches.

The different plantings were placed adjoining one another in order that corresponding varieties of each planting could be arranged in corresponding positions.

After the corms were planted the soil was stirred frequently in order to keep the weeds down and the soil in good tilth.

No artificial watering was done because there is no method of watering which is satisfactory for such experimental work, for it is impossible to supply moisture that all plants will receive an equal amount under the same conditions. Also there was no fertilizer used, but the soil was well prepared at the time of planting so that little or no variation could be detected.

In order that a reliable comparison could be made of the many varieties planted at intervals, it was deemed necessary to make many measurements. Such measurements as width of leaves, length of leaves, average length of flowering stems were made. The measurements taken on width, length and number of leaves were recorded on the following dates: June 15, June

23, June 30, July 7, and at the time of digging, October 2.

Measuring the leaves was of great importance as shown in Photograph No. 1, page 25, the many varieties varied greatly in method of spread, length and width of leaves. For this reason the measurements were made as shown in Photograph No. 2, page 26.

Many of the corms of different varieties planted produced more than one flowering spike per corm, and the number of individual flowers per spike varied greatly. For this reason the number of flowering spikes and individual flowers were counted in order that a comparison could be made within the same variety of different plantings.

October 2, the corms were dug and placed in a storage shed. The leaves were not removed at the time of digging but were allowed to remain attached to the corms until the leaves had dried. The leaves were then removed, corms cleaned, weighed and counted.

WEATHER CONDITIONS DURING THE GROWING SEASON

The weather conditions varied so greatly during the growing season that much of the fluctuations in the tables can be largely contributed to such variations in climate. Facts pertaining to weather conditions were obtained from Iowa Section of the United States Weather Bureau (9).

The principal feature of the weather during the month of April was that of extreme dryness which was common through

out the state. Such a lack in precipitation showed its effects by a lack of usual humidty and accompanied by many dust storms. There were no unusually low temperatures during the month of April but temperatures below freezing occured on an unusually large number of days. Such a combination of weather condition greatly retarded the development and growth of all vegetation.

The climatic conditions for the month of May were also very uncommon. Although there were numerous fluctuations in temperature there was, in general, a marked excess in temperature during May.

The last frost occured on May 22nd, but the damage was not severe. The amount of precipitation was much less than was needed for at the end of the month severe drought was common in this locality.

During the greater part of the month of June the days and nights were disagreeably cool for spring crops. Such a condition associated with extreme dryness during the month of May caused the growth of the gladiolus to be checked considerably.

On June 2nd, the prevailing drought was broken, nevertheless the influence of the drought during the early portion of the growing season greatly checked the best development of the flowering crop.

For the month of July the mean temperature for the state averaged one degree above normal. The precipitation

for the state averaged only slightly below normal, but in the vicinity of Ames there was a decided deficiency in rainfall during July.

The month of August was in general very normal from the agricultural standpoint. There was, however, a general excess in temperature, the precipitation was somewhat above normal but well distributed about the state.

The month of September was very unusual. The outstanding weather conditions were that of frequent and abnormally heavy rains over practically the entire state. In general, the temperature was above normal with the exception of the last week.

For such a crop as the gladiolus the weather conditions were especially bad for the persistant rainy weather caused much abnormal growth and suspended and delayed the maturity of the corms so that when freezing weather occured on the 25th and 26th, the growth was quickly checked.

Tables 1, 2, 3, 4 and 5 show in detail the data which was recorded for each planting for all varieties.

TABLE 1

First Weekly Planting - April 23

Name of Variety	Weight of 10 Corms Planted (grams)	Av. Cir. of the 10 Corms Planted (cm.)	Date Leaves First Appeared	Date of First Bloom	No. of Flowering Stems	Av. Length of Flowering Stems (inches)	No. of Individual Blooms	Total No. of Leaves	Average Width of Leaves (cm.)	Av. Length of Leaves (cm.)	No. of Corms Produced	Weight of Corms Produced (grams)
Midsummer Dream	227	12.5	5/18	8/5	14	36	175	130	2.5	28.5	21	546
Sweet Orra	308	14.5	5/19	7/18	16	34	127	99	3.0	25.3	16	611
Alice Tiplady	317	14	5/14	7/28	20	33	182	156	3.0	25.0	22	826
Maiden's Blush	241	13.5	5/15	7/22	22	29	237	135	2.2	28.0	22	550
Sonia	223	12	5/13	7/30	17	37	157	123	2.5	29.2	20	546
Capella	299	13	5/16	7/29	19	38	194	132	2.8	29.1	20	542
Arcadia	248	12	5/9	8/5	15	42	212	127	2.9	34.2	18	455
Marshal Foch	295	13	5/9	7/15	14	27	128	110	2.5	29.1	16	490
Sarah Lillie (Diener)	307	14.5	5/17	7/18	17	32	134	115	3.2	26.0	17	783
Primunella	441	15	5/14	7/21	22	33	218	156	3.0	26/1	25	756
Sirius	241	13	5/13	7/8	22	31	236	174	3.2	22.2	26	714
Rose Pearl	235	11.5	5/8	7/13	10	29	125	95	2.2	30.6	8	309
Mrs. Francis King	280	14	5/19	7/25	7	32	93	98	2.0	31.0	17	644
Dunlap	216	11.5	5/10	8/5	11	35	149	118	2.9	30.2	13	462
Mary Fennel	265	14.5	5/9	7/23	18	28	188	116	2.1	27.1	18	447
Golden Gate	260	14	5/23	7/30	16	36	185	109	3.4	30.6	17	560
Topaz	216	11	5/13	7/23	22	32	252	140	2.7	26.2	22	756
Schwaben	288	14.5	5/17	7/27	18	32	113	118	3.3	27.0	22	755
Autumn Queen	259	14	5/18	8/3	4	38	84	53	2.4	31.3	8	336
	5166	13.2			304	33	3189	2304	2.7	28.2	348	11,088

TABLE 2

Second Weekly Planting -- May 1, 1926

Name of Variety	Weight of 10 Corms Planted (grams)	Av. Cir. of the 10 Corms Planted (cm.)	Date Leaves First Appeared	Date of First Bloom	No. of Flowering Stems	Av. Length of Flowering Stems (inches)	No. of Individual Blooms	Total No. of Leaves	Average Width of Leaves (cm.)	Av. Length of Leaves (cm.)	No. of Corms Produced	Weight of Corms Produced (grams)
Midsummer Dream	241	12.5	5/14	7/29	12	36	152	97	2.5	31	14	152
Sweet Orra	345	15	5/15	7/16	23	32	209	145	3.1	29	24	209
Alice Tiplady	287	14	5/14	7/25	21	31	191	162	3.2	24	22	191
Maiden's Blush	262	13.5	5/14	7/21	20	27	224	133	2.2	31	21	224
Sonia	204	13	5/16	8/5	23	34	216	126	2.7	33	24	216
Capella	345	15	5/19	7/25	21	39	234	125	3.5	34	21	234
Arcadia	235	12	5/14	8/13	19	42	300	114	2.9	32	17	300
Marshal Foch	315	15	5/14	7/20	19	27	149	116	2.5	30	19	149
Sarah Lillie (Diener)	285	14	5/17	7/19	15	34	129	96	3.4	25	13	129
Primunella	375	15	5/13	7/19	22	28	197	155	3.3	28	26	197
Sirius	275	13	5/10	7/19	24	33	302	160	2.8	31	26	302
Rose Pearl	284	12	5/16	7/15	14	31	142	99	2.6	31	11	142
Mrs. Francis King	305	15	5/13	7/29	17	33	241	132	2.5	34	21	241
Dunlap	176	10	5/14	8/11	11	44	208	111	2.7	31	11	208
Mary Fennel	235	14	5/13	7/28	12	30	126	90	2.0	28	15	126
Golden Gate	255	14	5/23	7/30	18	24	212	108	3.2	28	19	212
Topaz	295	13	5/11	7/25	24	32	314	179	2.7	25	28	314
Schwaben	294	14	5/14	7/28	14	35	228	89	3.0	31	15	228
Autumn Queen	244	13	5/13	8/15	6	33	82	62	2.2	31	8	82
	5257	13.5			353	33	3856	2299	2.8	30	355	13,856

TABLE 3

Third Weekly Planting - May 8, 1926

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Name of Variety	Weight of 10 Corms Planted (grams)	Av. Cir. of the 10 Corms Planted (cm.)	Date Leaves First Appeared	Date of First Bloom	No. of Flowering Stems	Av. Length of Flowering Stems (inches)	No. of Individual Blooms	Total No. of Leaves	Average Width of Leaves (cm.)	Av. Length of Leaves (cm.)	No. of Corms Produced	Weight of Corms Produced (grams)
Midsummer Dream	228	12	5/23	7/31	15	37	176	100	2.7	31	15	657
Sweet Orra	280	14	5/18	7/17	19	35	146	118	2.9	30	20	896
Alice Tiplady	212	13	5/17	7/22	19	31	160	120	3.0	27	17	659
Maiden's Blush	214	12.5	5/18	7/25	21	32	216	126	2.3	29	26	658
Sonia	244	13	5/18	8/1	21	37	208	124	2.3	30	25	644
Capella	274	13	5/24	7/29	25	41	279	151	2.9	33	26	952
Arcadia	252	13	5/18	8/17	15	48	246	129	2.8	31	17	490
Marshal Foch	264	13	5/24	7/25	11	27	104	103	2.5	30	12	490
Sarah Lillie (Diener)	263	13	5/24	7/19	16	31	105	92	3.3	25	14	546
Primunella	362	14	5/24	7/24	25	29	196	144	2.9	27	25	1067
Sirius	230	13	5/24	7/17	29	32	302	181	3.3	27	33	644
Rose Pearl	260	12	5/23	7/17	13	31	118	96	2.0	30	13	364
Mrs. Francis King	272	13.5	5/24	7/30	14	34	159	99	3.4	32	13	546
Dunlap	128	10	5/24	8/24	12	42	192	94	2.6	31	12	335
Mary Fennel	253	13	5/18	7/29	13	28	147	94	1.8	28	13	420
Golden Gate	282	14.5	5/24	8/4	18	34	192	118	3.4	28	20	490
Topaz	185	11	5/18	7/25	27	31	265	187	3.1	29	29	799
Schwaben	290	14	5/28	7/31	17	37	224	82	3.9	31	18	714
Autumn Queen	210	13	5/24	8/15	7	37	83	66	2.1	33	9	448
	4705	12.8			325	34	3518	2224	2.7	30	361	11,819

TABLE 4

Fourth Weekly Planting - May 15, 1926

Name of Variety	Weight of 10 Corms Planted (grams)	Av. Cir. of the 10 Corms Planted (cm.)	Date Leaves First Appeared	Date of First Blooming	No. of Flowering Stems	Av. Length of Flowering Stems (inches)	No. of Individual Blooms	Total No. of Leaves	Average Width of Leaves (cm.)	Av. Length of Leaves (cm.)	No. of Corms Produced	Weight of Corms Produced (grams)
Midsummer Dream	235	12	5/28	7/17	18	37	212	126	2.4	31	19	616
Sweet Orra	287	14	5/27	7/7	22	39	225	130	2.6	28	24	882
Alice Tiplady	305	14	5/28	7/7	25	32	221	183	3/4	29	26	826
Maiden's Blush	225	13	5/28	7/26	20	33	170	139	2.2	27	22	631
Sonia	227	13	5/28	8/4	22	37	211	128	2.7	33	22	617
Capella	417	15	5/27	7/30	24	44	241	139	3.1	33	25	883
Arcadia	255	12	5/29	8/20	13	46	298	109	2.8	37	16	405
Marshal Foch	243	12	5/29	8/2	14	27	107	90	2.2	26	15	433
Sarah Lillie (Diener)	295	14.5	5/30	7/26	17	32	121	85	2.7	24	15	435
Primunella	327	14	5/29	7/26	18	25	167	110	2.9	27	23	560
Sirius	201	12	5/30	8/6	22	29	234	144	2.8	25	25	434
Rose Pearl	142	10.5	5/29	7/24	10	32	101	87	2.3	26	11	351
Mrs. Francis King	271	14	5/30	7/8	18	34	110	108	2.2	31	18	462
Dunlap	101	10	5/29	8/24	10	38	143	76	2.2	28	10	253
Mary Fennel	234	14	5/30	8/3	16	26	128	106	1.5	26	17	366
Golden Gate	218	13	5/30	8/2	19	32	161	122	3.0	29	22	462
Topaz	207	11	5/28	7/28	25	33	271	168	2.6	26	26	687
Schwaben	254	14	5/30	8/19	18	35	224	114	2.5	25	21	574
Autumn Queen	187	12	6/2	8/19	6	37	72	54	3.4	33	8	284
	4631	12.8			337	34	3417	2218	2.6	26	365	10,161

TABLE 5

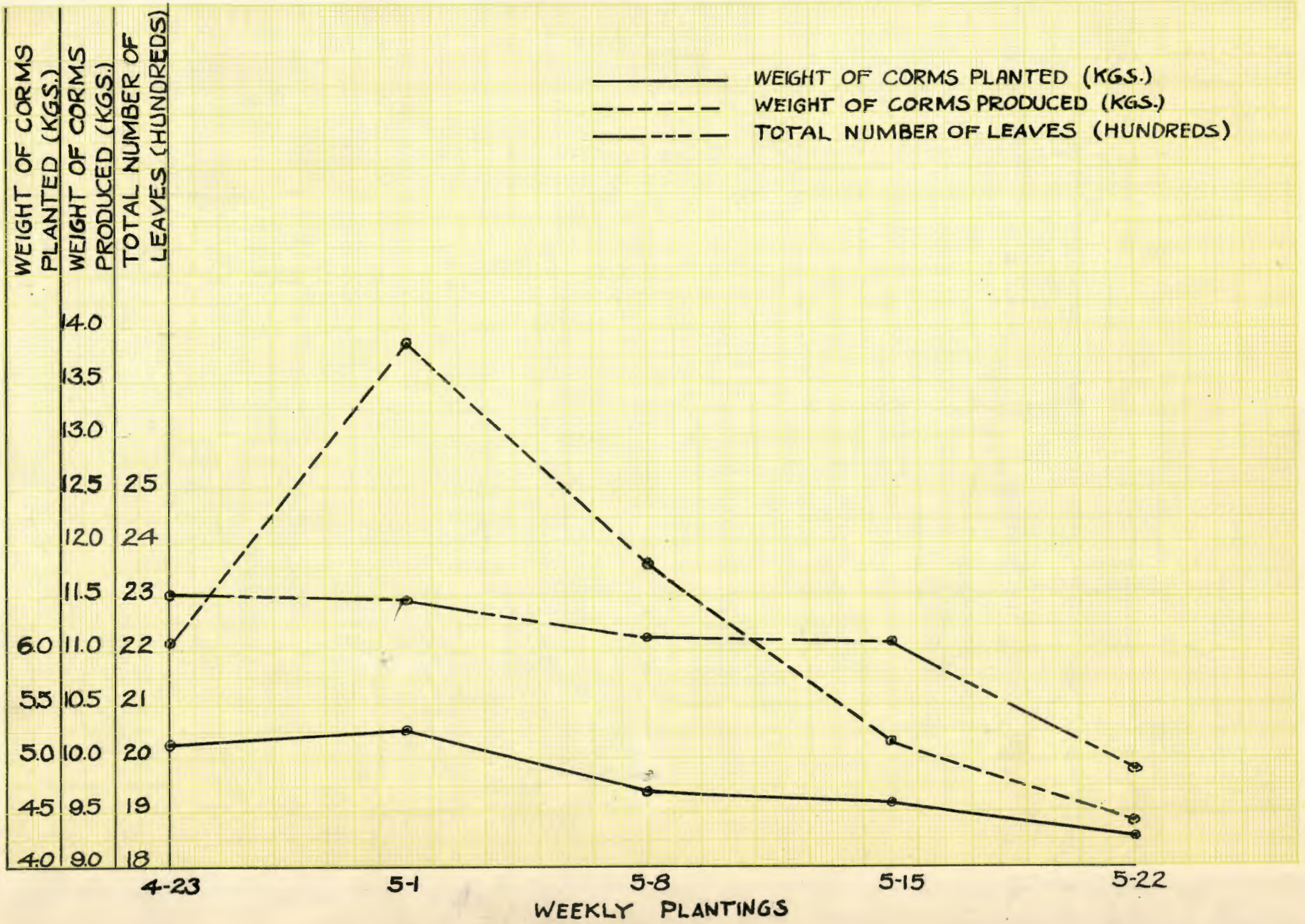
Fifth Weekly Planting - May 22, 1926

Name of Variety	Weight of 10 Corms Planted (grams)	Av. Cir. of the 10 Corms Planted (cm.)	Date Leaves First Appeared	Date of First Bloom	No. of Flowering Stems	Av. Length of Flowering Stems (inches)	No. of Individual Blooms	Total No. of Leaves	Average Width of Leaves (cm.)	Av. Length of Leaves (cm.)	No. of Corms Produced	Weight of Corms Produced (grams)
Midsummer Dream	165	11	6/1	8/9	18	35	185	117	2.6	29	20	541
Sweet Orra	313	14	5/30	7/25	21	22	161	105	2.8	29	20	826
Alice Tiplady	303	15	5/30	8/10	21	33	209	123	2.9	27	23	645
Maiden's Blush	169	11	6/2	8/12	16	28	161	106	2.1	28	18	267
Sonia	206	13	6/1	8/12	21	28	211	107	2.1	29	24	504
Capella	352	15	5/30	8/8	24	44	307	151	2.5	31	27	729
Arcadia	182	11	6/3	8/16	13	38	172	85	2.2	30	14	294
Marshal Foch	256	13	6/2	8/14	11	30	110	83	2.3	26	12	351
Sarah Lillie (Diener)	265	13	6/1	7/29	18	38	141	107	3.1	26	19	592
Primmella	365	15	6/1	7/30	26	32	248	169	3.5	30	27	784
Sirius	292	14	6/1	8/8	24	29	283	152	3.3	31	24	473
Rose Pearl	115	10	6/3	7/27	6	27	50	56	1.8	26	8	258
Mrs. Francis King	273	13	6/3	8/12	17	35	230	112	2.4	32	22	519
Dunlap	84	9	6/3	8/15	10	37	142	82	2.4	25	10	280
Mary Fennel	235	14	6/3	8/10	14	32	144	83	2.3	28	15	392
Golden Gate	194	12	5/30	8/2	13	35	143	74	2.8	35	13	504
Topaz	150	11	5/30	8/4	18	34	259	139	3.0	25	20	519
Schwaben	193	11	6/3	8/8	13	34	267	86	3.5	29	16	657
Autumn Queen	175	11	5/30	8/2	5	37	78	45	2.2	33	8	294
	4267	12.4			309	33	3501	1982	2.6	29	340	9429

TABLE 6

Comparison of Results Taken From Tables 1, 2, 3, 4 and 5

Date of Planting	Weight of 190 Corms Planted	Av. Cir. of 190 Corms Planted	No. of Flowering Stems	Av. Length of Flowering Stems (in.)	No. of Individual Blooms	Total No. of Leaves	Av. Width of Leaves (cm.)	Av. Length of Leaves (cm.)	No. of Corms Produced	Wt. of Corms Produced	Percent Increase in Wt. of Corms
April 23	5166	13.2	304	33	3189	2304	2.7	28.2	348	11,088	212
May 1	5257	13.5	333	33	3856	2299	2.8	30.0	355	13,856	248
May 8	4703	12.8	323	34	3518	2224	2.7	30.0	361	11,819	251
May 15	4631	12.8	337	34	3417	2218	2.6	26.0	365	10,161	210
May 22	4267	12.4	309	33	3501	1982	2.6	29.0	340	9,429	220


WEIGHT OF CORMS PLANTED (KGS.)
WEIGHT OF CORMS PRODUCED (KGS.)
TOTAL NUMBER OF LEAVES (HUNDREDS)
WEIGHT OF CORMS PLANTED (KGS.)
WEIGHT OF CORMS PRODUCED (KGS.)
TOTAL NUMBER OF LEAVES (HUNDREDS)
14.0
13.5
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
25
24
23
22
21
20
19
18
6.0
5.5
5.0
4.5
4.0
4-23
5-1
5-8
5-15
5-22
WEEKLY PLANTINGS

DISCUSSION OF RESULTS

From the results of the previous Tables 1, 2, 3, 4 and 5, Table 6 was constructed. The purpose of this table is to show in detail how plantings at weekly intervals compare when many factors are considered.

As shown in Table 6, there was considerable variation in the weight of corms planted at different intervals. However, the weight of corms planted did not always correspond to the number of flowering stems, length of flowering stems, number of individual blooms, number of leaves, width of leaves, length of leaves, number of corms produced, and weight of corms produced. For this reason it is believed that weather conditions have considerable influence on the growing conditions of such plants.

Also as shown in Table 6, the first planting did not respond to early planting as expected, for although the corms were of good size and weight when planted, and a few more leaves developed, the leaves lacked length and width, and the number and weight of corms produced was less than for the second and third planting. This may be partly due to abnormal soil moisture at the time of the first and second planting periods.

There has been a general conception, however, that early planting of corms will result in more and larger leaves, thus having a great influence on the quality, number and size of flowers and corms produced.

Such a conception must not always hold true for all plants, for as indicated in Table 6, there is but very little variation in the number of flowering stems, length of flowering stems, number of individual blooms, total number of leaves and size of leaves for the different plantings.

From the data given in Table 6, we can conclude that the number of flowering stems and individual flowers are determined before the time of planting. If the inflorescence is so developed, climatic conditions would have but very little or no effect on the number of leaves and flowers produced, but would greatly influence the quality of such leaves and flowers.

The effect of time of planting on the time of blooming varied greatly with most of the varieties planted. In only a few varieties did the time of blooming correspond with the time of planting. For as shown in previous tables, in many cases the second or even the third planting bloomed before the first.

Graph on page 20 shows the relation of the weight of corms planted to the weight of corms and number of leaves produced. With the exception of the second planting, the decrease in weight of corms at weekly intervals is believed to be greatly due to evaporation. The corms were not weighed at the same date, but were weighed at the time of planting. Thus the corms for the fifth planting were held under storage con-

ditions for five weeks longer than the first.

The weight of corms planted and time of planting apparently affected the weight of corms produced.

The number of leaves to develop corresponded to the date of planting. However, a histological study of many corm buds show that leaves are differentiated during the period of corm formation. The number of leaves found per bud varied from five to seven, depending on the size of bud studied. If the number of leaves are differentiated before the time of planting, the number of leaves would be expected to be approximately the same for each planting. However, unless the growing period is sufficiently long that the plants may reach maturity less leaves would be expected to appear even though they were differentiated before time of planting.

CONCLUSIONS

1. A succession of blooms may be obtained if corms are planted at intervals from the latter part of April until July 1st.
2. All varieties do not respond in the same degree to a succession of planting.
3. For each seven days delay in planting, the period of blooming was retarded from one to four days.
4. Difference in time of planting had no effect on the number of flowering stems, length of flowering stems, number of individual blooms or number of corms produced.
5. Early plantings produced blooms of superior size and quality. Such a result is believed to be due to slow sturdy growth which the plants made during the early growing season.
6. The number of leaves to develop corresponds to the date of planting.
7. Early planting did not increase the size or number of corms, but did result in the production of a greater number of cormels.
8. Judging from the results obtained, it appears as if flower bud formation may have taken place in the corm previous to date of planting. A histological investigation of buds taken from several corms during early dormancy of the Sirius variety showed leaf differentiation but no inflorescence.

Plate 1

Plate 1 shows great variety variation and characteristics in type, size, and shapes of various varieties of gladiolus. Corms planted the same date.
Varieties: 1. Midsummer Dream, 2. Sweet Orra, 3. Alice Tiplady, 4. Salmon Beauty, 5. Maiden's Blush, 6. Sonia, 7. Sirunus, 8. Mrs. Francis King, 9. Dunlap, 10. Golden Gate, 11. Topaz, 12. Autumn Queen.

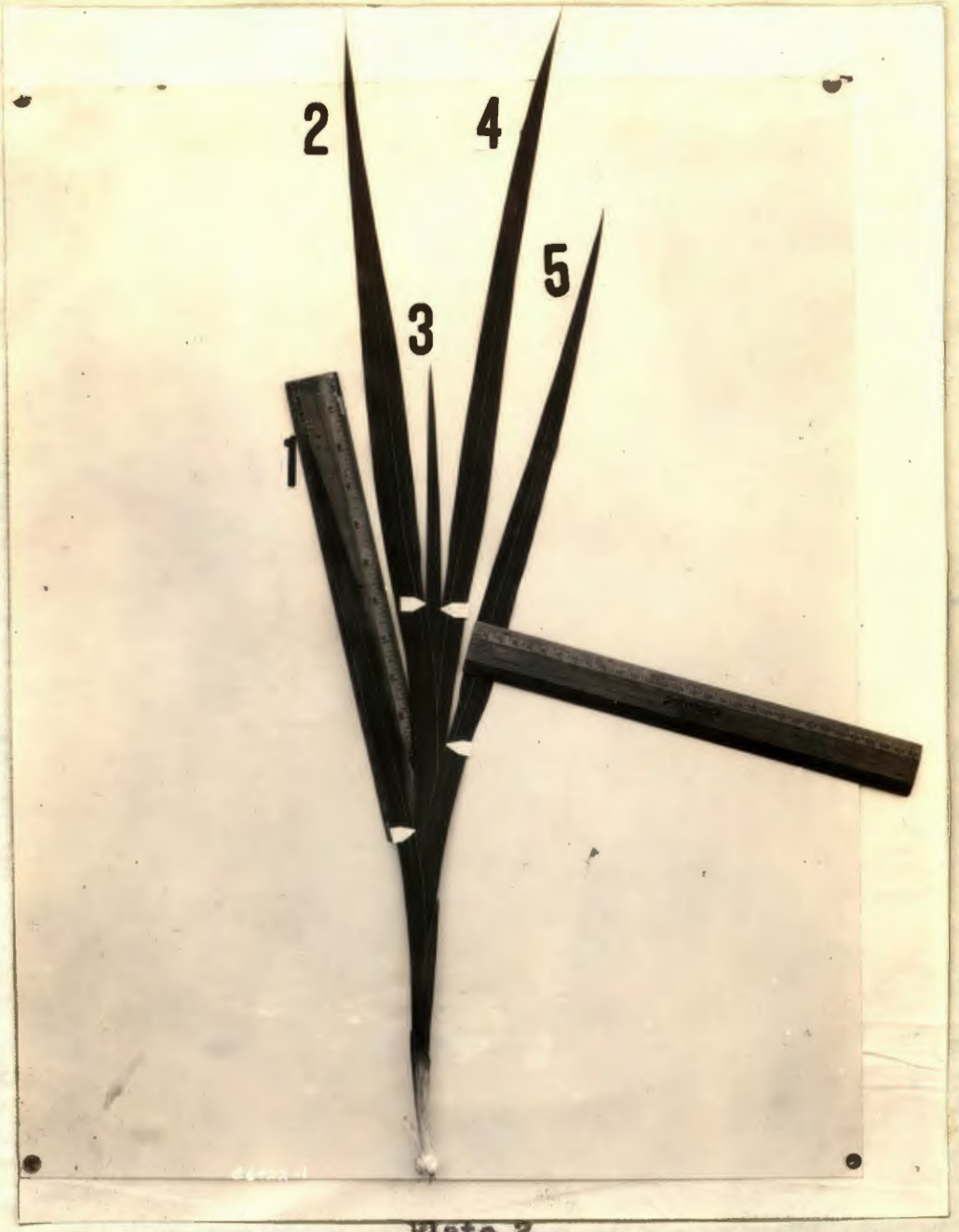


Plate 2

Plate 2 shows in detail the method of taking measurement of the length and width of leaves of the gladiolus. The width of leaf No. 5 is 2.2 cm. The length of leaf No. 1 is 27 cm. The purpose of taking measurement at various stages of growth was not to compare the growth of one variety with another but to compare growth of the same variety which were planted at weekly intervals.

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